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TRANSACTIONS

OF THE

American Fisheries Society.

TWENTY-FOURTH ANNUAL MEETING.

Held in New York,

Wednesday and Thursday, June 12th and 13th, 1895.

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OFFICERS FOR 1895-'96.

PRESIDENT, L. D. HUNTINGTON ...... *New Rochelle, N. Y.*

VICE-PRESIDENT, CALVERT SPENSLEY . *Mineral Point, Wis.*

TREASURER, FRANK J. AMSDEN........... *Rochester, N. Y.*

REC. SEC'Y, TARLETON H. BEAN, *Battery Park Aquarium, New York.*

COR. SEC'Y, H. B. MANSFIELD, U. S. N..... *Brooklyn, N. Y.*

EXECUTIVE COMMITTEE.

HENRY C. FORD,.......... *1823 Vine St., Philadelphia, Pa.*

H. P. FROTHINGHAM..... .... *Mt. Arlington, N. J.*

HERSCHEL WHITAKER .... *Detroit, Mich.*

EDWARD P. DOYLE .... *Port Richmond, S. I., N. Y.*

W. L. MAY .... *Omaha, Neb.*

W. de C. RAVENEL, U. S. Fish Com....... *Washington, D. C.*

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MINUTES

OF THE

TWENTY-FOURTH ANNUAL MEETING

OF THE

AMERICAN FISHERIES SOCIETY,

HELD IN

NEW YORK AQUARIUM,

Castle Garden, N. Y.,

ON WEDNESDAY, JUNE 12TH, 1895.

The following members were present on roll call:

W. L. May,	Omaha, Nebraska.
Herschel Whitaker,	Detroit, Michigan.
Fred. Mather,	Cold Spring Harbor, N. Y.
H. C. Ford,	Philadelphia, Pa.
Frank J. Amsden,	Rochester, N. Y.
H. B. Mansfield,	U. S. Navy.
William H. Bowman,	Rochester, N. Y.
David G. Hackney,	Fort Plain, N. Y.
Robert Hamilton,	Cambridge.
Dr. Bushrod W. James,	Philadelphia, Pa.
Tarleton H. Bean,	New York.
W. deC. Ravenel,	Washington, D. C.
J. J. Stranahan,	Put-in-Bay, Ohio.

John W. Titcomb,	St. Johnsbury, Vermont,
J. W. Hoxie,	Carolina, R. I.
H. W. Davis,	Grand Rapids, Michigan.
L. D. Huntington,	New York.
Edward P. Doyle,	New York.
A. N. Cheney,	Glens Falls, N. Y.

President W. L. May, of Omaha, Nebraska, presided.

After the roll call, the President announced that in order to facilitate business he would appoint Committees on Nominations, Auditing the accounts of the Treasurer, and on time and place of next meeting. The Committees appointed were as follows :

Committee on Auditing accounts of Treasurer—

Henry C. Ford,	Philadelphia, Pa.
H. W. Davis,	Grand Rapids, Michigan.
Henry H. Lyman,	Oswego, N. Y.

Committee on Nominations—

Herschel Whitaker,	Detroit, Michigan.
W. H. Bowman,	Rochester, N. Y.
G. F. Peabody,	Appleton, Wisconsin.
H. B. Mansfield,	New York.
H. C. Ford,	Pennsylvania.

The *Committee on location of place of next meeting* was as follows :

B. H. Davis,	Palmyra, N. Y.
James A. Dale,	York, Pa.
J. W. Hoxie,	R. I.

The following gentlemen were elected to membership in the Society :

N. R. Buller,	Carolina, R. I.
W. C. Clark,	Newark, N. J.
D. P. Corwin,	Pittsburg, Pa.
Dr. Jas. A. Dale,	York, Pa.
B. H. Davis,	Palmyra, N. Y.
H. B. Frothingham,	Mt. Arlington, N. J.
Monroe A. Green,	Rochester, N. Y.
C. E. Griffith,	Staten Island, N. Y.
G. Hansen,	Osceola, Wis.
Hiram F. Hurlbut,	Lynn, Mass.
A. A. Hynemann,	55 W. 33d St., New York.
G. E. Jennings,	317 Broadway, New York.
Dr. O. L. Jones,	30 W. 35th St., New York.
J. Harrington Keene,	Greenwich, N, Y.
Henry H. Lyman,	Oswego, N. Y.
Dr. Justus O'Hage,	St. Paul, Minn.
Parker Page,	West Summit, N. J.
Geo. F. Peabody,	Appleton, Wis.
G. Pfieffer, Jr.,	Camden, N. J.
E. T. Rowinvill,	East Freetown, Mass.
Edward Thompson,	Northport, N. Y.
W. R. Weed,	Potsdam, N. Y.

The President then called for a list of the papers to be offered at the meeting. The following papers were presented to be read:

1. *The Influence of Railroads on Fish Culture.* Fred. Mather.

2. *The Decadence of our Trout Streams.* J. S. Van Cleef.

3. *Impoverishment of the Food Fish Industries.* Dr. Bushrod W. James.

4. *The Distribution of the Trout Family.* W. D. Tomlin.

5. *Epidemic among Trout in Nebraska.* M. E. O'Brien.

6. *Observations on the Moral Phases of Modern Fish Culture.* Herschel Whitaker.

7. *The Work of the United States Fish Commission.* Tarleton H. Bean.

8. *A New Hatchery.* Herschel Whitaker.

9. *The Artificial Hatching of White Fish and Brook Trout, and the relations of planting to results.* Seymour Bower.

10. *The work of the State Association for the protection of Fish and Game.* F. J. Amsden.

11. *Disease of Trout in Caledonia Creek.* Prof. C. W. Dodge.

The Committee on time and place of next meeting presented its report, and recommended that New York City be selected as the place of the twenty-fifth meeting of the Society, the time to be the third Wednesday and Thursday of May, 1896. On motion the report was received and adopted. On motion the Society took a recess until one o'clock for lunch.

When the Society reconvened at one o'clock the President declared the first thing in order was the presentation of the reports of Committees. The Committee on Nominations recommended the following officers for the ensuing year:

L. D. Huntington, New York, *President.*
C. Spensley, Wisconsin, *Vice-President.*

T. H. Bean, New York, *Recording Secretary.*
F. J. Amsden, Rochester, New York, *Treasurer.*
H. B. Mansfield, Brooklyn, *Cor. Secretary.*

Executive Committee—

Henry C. Ford,	Philadelphia, Pa.
H. P. Frothingham,	N. J.
Herschel Whitaker,	Detroit, Michigan.
Edward P. Doyle,	New York.
W. L. May,	Omaha, Nebraska.
W. deC. Ravenel,	Washington, D. C.

The report of the Committee was received and on motion approved, and the Secretary was directed to cast one ballot for each of the officers named in the report. The Secretary cast the ballots as directed, and the officers were declared elected.

The Committee on auditing the accounts of the Treasurer presented their report which, upon motion, was approved as read.

Mr. Bowman, of New York, offered the following resolution which, upon motion, was adopted :

Resolved, That a Committee of Five, consisting of one Commissioner from each of five States, be appointed to secure, if possible, uniformity of legislation for the protection and preservation of Fish and Game in the several States in the Union.

Mr. Bowman offered another resolution which, upon motion, was adopted :

Whereas, it is conceded by all parties, both commercial fishermen and others, that in the inland waters of the different States as well as in the Great Lakes, so called, the supply of food fish is decreasing annually, and that in some waters the supply has entirely disappeared.

Therefore, Resolved, that it is the unanimous opinion of this Society that stringent laws should be prepared by the legislatures of the several States to prevent the pollution of streams, to make a close season for all fish during their spawning seasons, and to prevent the taking and sale of fish until they have reached a proper size and age. That the size of meshes of all nets should be regulated. That such protection should be given by law that the full efforts of artificial propagation can be realized.

W. L. Powell, of Pa., offered the following resolution which, upon motion, was adopted:

Resolved, that the Governors of the several States, by virtue of their positions, be honorary members of the Society.

The Committee on Nominations then made a further report which, upon motion, was adopted. The report was as follows:

The committee recommend that the style and character of the report of our Transactions be changed, and that hereafter the report shall show in the natural order in which they occur the transactions of the Society, the discussion to follow each paper as it occurred, and that the Transactions be published within 60 days after the meeting.

We further recommend that the Rec. Sec'y be directed to notify each member of the Society of the date of the next meeting a month before the same shall take place, and that a copy of Transactions be mailed to each honorary member of the Society. That he also be requested at the same time to ask members to contribute papers to be read at the following meeting, and that the titles of such papers be sent him.

Respectfully submitted,

Herschel Whitaker,
H. B. Mansfield,
Geo. F. Peabody,
Henry C. Ford,
Wm. H. Bowman.

Mr. Huntington, of New York, presented the following resolution which, upon motion, was adopted:

Resolved, that it is the sense of this Society that no fish or fry should be distributed at public expense for private waters.

Dr. Bean, of the United States Fish Commission, seconded the resolution and stated that the States now had regulations against such private distribution of fry, but that the United States still granted free fish for private waters, from which the public can derive no benefit.

The reading of the papers then began and continued until six o'clock P. M., and a resolution was adopted providing for a recess until ten o'clock the next day.

Minutes of adjourned meeting of the American Fisheries Society, held Thursday June 13th, 1895, on board the steamboat "Sam Sloan."

All the delegates in attendance at the conference were present; President W. L. May in the chair.

Mr. L. D. Huntington, of New York, offered the following resolution which, upon motion, was adopted.

Resolved, That the Secretary of this Society enter upon its minutes an expression of the hearty gratitude of its members for the magnificent entertainment provided for them by the New York State Commissioners of Fisheries, Game and Forests;

And be it further Resolved, that there be entered the special thanks of this Society to the Hon. John H. Starin, through whose courtesy the Commissioners of Fisheries, Game and Forests were enabled to provide so commodious and elegant a steamboat;

And be it further Resolved, that the thanks of the Society be extended to the Hon. Edward Einstein, President of the Department of Docks, for the privilege of landing at Pier A, Battery, and the further thanks of the Society to the Department of Public Parks of the City of New York, through whose courtesy the Society was permitted to use the Aquarium for the purposes of their annual session.

Mr. Huntington also introduced the following resolution which, upon motion, was adopted:

Resolved, That the thanks of this Society be extended to the outgoing Officers of the Association for the services rendered by them to the Society during the past year.

Mr. Herschel Whitaker, of Detroit, Michigan, introduced the following resolution which, upon motion, was adopted :

Resolved, That the thanks of this Society be extended to Mr. Thompson and the Northport Oyster Company for the very kind courtesy they have extended to us in the use of the steamer "Mystery" for the purpose of explaining the cultivation of shellfish.

A resolution was then introduced by Mr. Whitaker, and passed, making J. Sterling Morton, a member of the Cabinet, Washington, D. C., an honorary member of the Society.

The following resolution was offered by Mr. Herschel Whitaker and, on motion, was adopted.

Resolved, That the American Fisheries Society desires to congratulate the Board of Parks of the City of New York upon the establishment of a free public Aquarium at Castle Garden. The installation of such an Aquarium reflects credit upon the city which has promoted it, and will serve to entertain the people with a continuous and pleasing exhibit of the common and rare forms of the fauna and flora of her waters, and the student will be afforded an opportunity for scientific observation furnished nowhere else in America.

We further desire to congratulate the Board in securing the services of Dr. Tarleton H. Bean as Director, who brings to this particular work such ripe experience and broad information as to insure the success of the enterprise.

Mr. Mather then said that recently he saw in the Fishing Gazette that Mr. Samuel Wilmot, with whom he had been acquainted for many years, had been retired on half pay as a reward for faithful and continuous service. Mr. Mather suggested that, as this was commonly done in Canada and Great Britain, it might be appropriate for the Fisheries Society to recommend that some sort of custom of this kind be resorted to in this country as a reward for long and faithful service.

On motion, the Society adjourned.

EDWARD P. DOYLE,

Secretary.

REPORT OF RECORDING SECRETARY.

GENTLEMEN:

A plan was adopted at the meeting at Philadelphia last year by which the membership, it was thought, of the American Fisheries Society could be very largely increased. The Secretary was associated with the Committee, and an attempt was to be made to get into the membership of the Society very prominent men interested in the preservation and propagation of fish and game in the United States. The great pressure of business, however, on the part of the Recording Secretary, prevented him from carrying out the object of the resolution, and the result is that, although several thousand circulars were sent out, no attempt was made to follow up the first circular, and an increase of fifteen or twenty members was all that the Society secured during the past year. This fact, however, does not affect the belief of the Secretary that the membership of the Society could be very easily increased to several thousand members, and made one of the most important associations of its kind in the world. Whenever a man, interested in the object of the association is approached properly, his name can be secured, and a thorough and systematic canvass of fish and game people of the United States would certainly secure an extremely large and valuable membership. The Society then would become of great importance in recommending and determining legislation, and in furthering the investigations of fish and game. I would suggest that some Committee of the members, composed of men who have leisure and who are enthusiastic for the protection of fish and game, be formed, and that this Committee be authorized to employ somebody and cause to be made a thorough canvass of the United States, using as a basis the present members of the Fisheries Society. In this way, I believe the membership could be swelled to three or four thousand members. The membership of the Society is now about 225. Nearly all the Fish Commissioners of the United States are members, and a number of prominent Fish Culturists, but the membership, of course, is not what it should be. I hope that this matter will receive the careful consideration of the Society at this meeting, and that every endeavor will be made to take the necessary steps to secure a larger and more influential membership.

Very respectfully yours,

EDWARD P. DOYLE.

TREASURER'S REPORT.

FRANK J. AMSDEN,
IN ACCOUNT WITH
AMERICAN FISHERIES SOCIETY.

DR.

To amount received from Dr. R. O. Sweeny, Sr.	$80.65	
Membership dues received to June 12th, 1895	111.00	
		$191.65

CR.

Bill for stationery	$16.25	
" " stenography	15.44	
" " "	4.00	
" " membership book	11.25	
" " part payment on printing Transactions, 1894,	80.65	
Cash on hand	64.06	
		$191.65

FRANK J. AMSDEN,
Treasurer.

NEW YORK, June 12th, 1895.

Approved,
HENRY C. FORD,
H. W. DAVIS,
H. H. LYMAN,
Auditing Committee.

THE INFLUENCE OF RAILROADS ON FISH CULTURE.

READ BEFORE THE AMERICAN FISHERIES SOCIETY, BY FRED MATHER, COLD SPRING HARBOR, N. Y.

The continual extension of railroads has been an important factor in stimulating fish culture, and has had a most important bearing on it that is worth considering. When I am asked why shad are not cheaper, now that so many millions of eggs are taken from fish caught for market and are hatched and added to the natural product of the rivers, I answer, "railroads." If the question refers to the price of oysters, lobsters or the fresh-water fishes of the Great Lakes, the same answer is returned.

Forty years ago the Hudson River furnished all the shad for New York City and for a district included in two strips thirty miles back from each bank of the river as far north as Troy. Farmers drove in to the fishing grounds and bought shad to salt for winter use and in the height of the season they could be bought at the nets for from three to five dollars per hundred. In Albany they retailed at two for a quarter of a dollar, and some times for less. Lobsters were retailed at about five cents per pound and were seldom seen under four pounds weight, oftener six to eight pounds. Before the building of the Boston and Albany Railroad teams came through to Albany from Boston, when sleighing was good, loaded with boxes of fresh codfish, haddock, pollock and kegs of opened oysters. The latter were in quart, two quart and gallon sizes. The Hudson River Railroad was not built and the only source of supply of sea-food in winter was from Boston. In summer the steamboats brought some shell oysters to Albany, but the demand was light and the shipments were not as prompt as now and I often heard it said that we never got good oysters in Albany! To-day they can be had in Omaha, owing to fast trains, prompt express service and the use of ice, for it must be remembered that there were no express companies in those days, and the great New York Central Railroad did not exist as a continuous line. From Albany to Rochester there were three railways; the Albany and Schenectady, the Schenectady and Syracuse, and the Syracuse and Rochester via Auburn and Canandaigua. These roads did not sell tickets, nor check baggage, beyond their own lines, and if passengers were delayed by stops to transfer and re-check baggage, freight was sure of long delays. No wonder, then, that the inland towns of the State of New York in those days never saw an oyster in the shell, nor a shad. Ice was then a luxury and we only got a few lobsters because they spoiled so quickly that it did not pay to risk large shipments. Under these circumstances it is plain that shad, lobsters and sea fish did not get far beyond Albany and Troy, the head of navigation on the Hudson.

In boyhood days, forty-five to fifty years ago, I did not see either hard or soft crabs in Albany, but my father was part owner in and agent for the Eckford line of barges engaged in freighting between Albany and New York, before canal boats were towed down the river, and my main desire for a trip to the great city was to buy boiled hard crabs along the dock for a cent a piece and go down the pier and eat them, regardless of smeared face and fingers. Now soft crabs are common in Chicago; packed in sea weed and kept cool they are whirled through in good shape.

In the early days of which I have spoken and up to twenty years ago no shad came to New York from Florida, nor even from North Carolina, where some of the finest come from to-day, and the citizens of the great metropolis waited for the first shad to be taken in New York Bay. This was an event in the year that was heralded far and wide and hotels bid high for the first fish, as much as twenty-five dollars, having frequently been paid for the honor of serving the first shad of the season by the Astor House and other hotels. Now that Florida begins to send shad in mid-winter, the strife for the first "North River" shad is ended.

Having glanced at the different conditions of railroading some decades ago and noted the effect upon the fish markets of inland towns, let us see how the changed conditions affect fish culture, which only began operations on a large scale well within twenty years. The pioneers in fish culture fondly expected to make fish cheaper for the masses. We expected to multiply certain species to such an extent that the market prices would be perceptibly lowered, and it is on record that the shad fishermen of Holyoke and South Hadley Falls, Mass., rebelled at the first efforts at shad hatching there by the late Seth Green because he said that he could "make shad cheap." He meant that they would be made plenty, and merely used the wrong word to the fishermen. We have increased the yield of shad in the Hudson, the Delaware and in other rivers farther south, but this increase of supply has been met by an increased demand that has kept prices up to, and even beyond, the old standards, and the extension of railways and the improved express facilities have made increased demands upon the shad fisheries that has kept, and will keep, the prices up, and perhaps increase them notwithstanding the increased production.

In this paper I have chosen to take the shad as an illustration of the effect that the railroads have had on fish culture in America, but the same line of argument is applicable to the white fish of the Great Lakes, which now reaches a hundred tables where it only fed one a quarter of a century ago. The oyster is more subject to an increased consumption by the extension of railroads than either the shad or the white fish, for it not only has a longer "season" but is not as perishable as the fish, and by the use of ice is now found on the "half shell" in most small towns, while in tins, both raw and cooked, it is a visitor to many mining camps.

But to return to the shad. The increase of population, and of fishermen with improved appliances along the Hudson River, would have exhausted the supply of shad without the help of railroads twenty years ago but for the aid of the fish culturist. The annual catch had been falling off for some years before the work of shad hatching was begun and continued to fall off for several years after, for the first work was done on a small scale. We know this in a general way by reports of the fishermen, for there had been no attempt to gather the fishing statistics until 1880; but both fishermen and marketmen from Troy to New York City, agreed that the supply had gradually fallen off, until many fishermen declared that it did not pay to wet their nets.

The work of shad hatching on the Hudson River was begun in a small way by the State Fish Commissioner in 1868, near Coeymans.

The next year work was not begun until the first day of June (second report, page 4), about a month late, and continued until July 13th. The report says: "Only 15,000,000 of shad were hatched in place of

300,000,000 as could doubtless have been done, had proper legislation been had." In 1870, there were 2,604,000 shad fry planted (see report for that year, page 4).

This, judging by the plants afterward made, was an average year, and it is possible that there was a typographical error in the figures for 1869. But, whatever may have been the number planted each year since the good work began it is certain that each young shad artificially hatched would never have seen daylight but for the aid of the fish culturist, for the eggs obtained were from fish caught for market and would have been wasted entirely, as they were too ripe to be eaten as "roe," for when within a week of maturity the ovarian sac is almost purple with the distended veins and not at all tempting as food, besides being very tender to handle, for the eggs are ready to drop apart.

This extra supply of young shad, preserved from danger during the egg and embryo stage and let loose at the time when ready to take food, supplements and reinforces the natural hatch in the river, which has gradually grown less each year, because of the increase of fishermen with improved appliances of capture to supply the increased demand occasioned by the extension of railroads.

Looked at in this light it will be seen that the natural hatch in the river must decrease in proportion to the number of fish caught, and only artificial propagation has kept the shad fisheries of the Northern States up to their former standard, and now that the southern rivers are beginning to feel the drain, they will soon have to look to shad culture to keep up their stock, or see it dwindle into next to nothing as the shad catch has done in the Connecticut River. This river furnishes a case in point. Its shad fisheries, once so famous, have fallen off until they are hardly sufficient for home consumption since hatching was discontinued at South Hadley Falls. In 1880 the catch of shad in the Connecticut was 268,608, or about equal to 1,074,432 pounds, with a value of $53,721. In 1889 the catch of the whole State of Connecticut, including the Housatonic, Connecticut and Thames Rivers was less than one-third of the catch of 1880, the official figures for the three rivers being 48,963 shad, weighing 195,852 pounds, and worth $16,580.

These figures for two different years would mean little did we not know that the falling off had been gradual, and that the catch has fluctuated with a downward tendency for the past six seasons.

The shad in the Hudson have been enabled to stand the drain caused by an increased local population and the shipments by rail by two factors: artificial fish culture and the newly worked southern rivers. I say "newly worked" because it is only a few years since the northern markets have taken great quantities of shad from the south. Ten years ago New York City was forced to look beyond the Carolinas for early shad, and Florida began to get her fish to the great market even as early as January; and how long these rivers will stand the increased fishing without crying for aid from the fish culturists remains to be seen. At present the hatching of shad is mainly done on the Hudson, the Delaware, Chesapeake Bay and the Potomac. Some work has been done on Virginia rivers and in North Carolina, but the work of the U. S. F. C., near Havre de Grace, where the Susquehanna loses itself in Chesapeake Bay, has been one of the most important stations. Last year the State of New York received over seven millions of shad fry from that place for planting in the Hudson, in addition to what hatching was done on that river.

According to the census of 1880 the catch of shad in the Hudson was 683,400 fish, which at an average of four pounds each would be 2,733,600 lbs., valued at $136,680, at wholesale. While I have not the figures at hand for any of the succeeding years I am informed by the fishermen that the river has more than held its own in the past fifteen years.

From the above statements it seems plain that while the fish culturist has been striving to increase the food supply, and possibly cheapen it, he has merely been successful in keeping the supply up to the increased demand, and the railroads have prevented any decrease in prices by taking all surplus above the local demand far inland, and thereby bringing to people distant fro n the fisheries delicious and wholesome food which has been produced by the fish culturist.

Last year Mr. Charles Hallock read a very interesting paper before this society, entitled "When shad were a penny a piece," in which he stated that "Connecticut shad in barrels were first advertised in Boston in 1736, though they were current in river towns for at least three years previous at one penny a piece, By 1773 prices had advanced to two or three pence." This was caused by lack of transportation to inland towns, and no matter how many shad we may produce, those prices will not be heard again, nor will the markets be glutted to the extent of lowering present prices, unless for an occasional day or two when the catch has been much larger than usual.

The extension of railroads will always drain the fisheries, which are limited in production, especially in the fresh waters. The shad only feed in fresh water during their first year of life and afterward get their growth at sea, but the pasturage for young shad, to borrow a word from the herdsman, is limited by the amount of food such as cyclops, copepoda, daphnia, etc., which are in turn limited by other causes. Therefore there is a natural limit to the capacity of every stream to produce fish, but that limit in our shad rivers and in our lakes has not even been approached by our labors in fish culture.

DISCUSSION ON THE PAPER OF MR. MATHER.

Dr. Bean: "I only want to call your attention to another epoch in the history of the introduction of the shad into rivers in which they were not native, in connection with the State of California. In 1872, Seth Green, I believe, carried the first young shad to California. In 1876 the first so called large shipment, consisting of 130,000 fry, was deposited by Mr. Frank Clark and myself in the Sacramento. After that time a few additional plants were made; the U. S. Commission carrying at most about two millions of eggs, which were hatched on the way, bringing the total of plants of shad in California to not more than five millions of fry.

"Speaking of the time when shad were a penny apiece, which I suppose was the English penny, equal to two cents in our money, that day was a parallel of the present time in California, for shad are now selling at wholesale at from one cent to two cents per pound in San Francisco. It struck me as a very interesting coincidence, and it is an illustration of what can be done by planting. The introduction of the shad on the Pacific coast stands out to-day as perhaps one of the most forcible illustrations of what artificial methods can do in our waters.

"The striped bass in California are now as plentiful as the shad, as a result of carrying them from

New York waters, and other eastern localities, ten or twelve years ago."

Mr. Goraud: "Is there not a proposition to exclude California shad from the New York market?"

Dr. Bean: "I don't know whether the California shad could be sold in the New York market, when they have been selling in the Chesapeake basin as low as six dollars per hundred, six cents apiece for large shad. Surely California could not compete, because the transportation would cost double as much as the shad."

Mr. Mather: "I have heard from several correspondents that shad weighing fourteen to sixteen pounds are common in the markets."

Dr. Bean: "There is a reason for the shad being cheap on the Pacific coast. The shad in California do not go to sea. They remain the year round in the bays or in brackish water near the river mouths. They are kept from going to sea by a wall of cold water and as a consequence they can be got in every month of the year. They have gradually spread into the estuaries along the coast until they are now known in southern Alaska."

Mr. Goraud: "Isn't the so called limit of size of the shad in eastern waters due to their excessive capture, which operates to prevent the growth of the fish? It has been said that in our forefather's time, when shad were a penny a piece they grew to large size."

Dr. Bean: "Within the last five years two shad weighing about thirteen pounds have been recorded. It is very difficult to say how increased fishing acts to diminish the size of the fish, because they are never caught until they come back into our fresh waters to spawn; they remain at sea and get their growth there."

Mr. Goraud: "If each year a certain percentage of fish is caught of course that operates to the disadvantage of the larger fish?"

Dr. Bean: "I presume it does, but they cannot be caught at any time except in the spawning season. There is no fishery for them at sea, and the catch is limited to the time when they return to the rivers to spawn."

Mr. Huntington: "I want to refer to a stream near Smithtown, L. I. There is a stream there perhaps three miles long that comes down to the waters of the Sound. Years ago there was taken there only an occasional stray shad. About ten years ago, I do not remember the exact date of the planting, there was a plant made by the State of N. Y. in that river, and for the last two or three years there has been quite good fishing. I was over there and spent a week in the shad time about three weeks ago, and at the house where I stopped I saw them have one morning three or four shad that weighed over ten pounds apiece. I cite this to show fishermen that shad will thrive in waters that are suitable for their introduction."

Mr. Whitaker: "I think perhaps the same factors will not operate in regard to the shad and other salt water fish as would in regard to the fresh water fish of the lakes. The fish are growing smaller and there is a cause for it. As the fish increase in size the meshes of the nets have been contracted, the fish pursued at every season of the year, and the size of the captured fish annually diminishes, whereas, as Dr. Bean has said, the migratory character of the shad protects them for perhaps nine or ten months of the year. They seek the deep water regions and do not return until they mature. They remain in the rivers only three months, and thus nature intervenes to protect them. It is gratifying to know that fish culture in the rivers has annually renewed the shad. The great obstacle to-day that is met with in almost every direction is the hand of man. There cannot be a better exemplification of the value of fish culture than the results with such fish as the shad and salmon. I think Mr. Mather's plan is an excellent one and his reference to the fact of the increase and poor maintenance of the stock in our waters, by reason of the distribution is right. In our great lake system, we have another thing to contend with, which is that a man has a right to fish throughout the year whenever he can, and this is a great obstacle to the propagation of the fish."

DECADENCE OF OUR TROUT STREAMS.

READ BEFORE THE AMERICAN FISHERIES SOCIETY

BY J. S. VAN CLEEF.

Some three or four years ago an article was contributed by me to Forest and Stream in which the above subject was discussed, and while this is not a reproduction of that article, it must necessarily contain many of the facts and conclusions which were contained in it and which further investigation satisfies me are correct.

Every angler who has waded and fished our trout streams during the past thirty or forty years has observed the general decrease in the waterflow, especially during seasons of drought, and the decrease does not seem to be local but universal.

The Legislature of this State has endeavored to arrest this decrease, especially in the North Woods, but in spite of legislative action it still goes on steadily and uniformly, both in the "forest primeval" and out of it.

This legislative action has been based upon the theory that the causes of the gradual diminution in the waterflow are and have been wholly or very largely local, and it seems to have been assumed that if the destruction of the trees at or near the sources of our streams can be prevented this decrease will be practically arrested.

Do the results thus far obtained justify this conclusion, or in other words, are these causes local, and can the preservation of the trees at the sources of our streams do more than retard a result which is inevitable from other and more far-reaching causes?

It has not been my fortune to visit the North Woods or Adirondack region, as my fishing trips have been confined to the Catskill region and Canada. For over thirty-five years, however, I have constantly visited the Catskills, and during all that time have been thoroughly familiar with the streams of that region; and while my personal knowledge of these streams does not extend much beyond thirty-five years, yet I feel assured that the statement of facts given below will be corroborated by many persons who could be named, and who have been familiar with these streams for over fifty years.

It will be conceded that, all other things being equal, like causes will produce like results, and if the North Woods and the Catskills are alike in their characteristics, then the causes which have produced and are producing a decrease in the waterflow of one of these regions will produce a like result in the other.

The eastern part of the State of New York is divided into two immense watersheds, the northern with its streams emptying into Lake Ontario, the St. Lawrence, Lake Champlain and the Mohawk River, and the southern with its streams emptying into the Mohawk, Hudson and Delaware Rivers.

Both of these regions are mountainous, and the altitude of these mountains and the intervening valleys above tide water are substantially the same.

The highest mountain in the northern watershed is Mt. Marcy, which is 5,468 feet high, and one of the highest in the State of New York is Slide Mountain, in the southern watershed, which is 4,205 feet high.

The lower watershed, which extends through Schoharie, Greene, Ulster, Sullivan and Delaware counties, contains fifty-nine mountains which are over 3,000 feet high. Of these, thirty-seven are of the height of 3,500 feet and upward, and of an average height of 3,728 feet.

Including this immense tract is what is generally known as the Southern Catskill range, contained within an area of perhaps thirty miles in length and twenty miles in breadth.

Fourteen mountains in this range are from 3,571 feet to 4,205 feet in height, the average height being 3,747 feet.

These mountains are covered with nothing but hard wood—beech, birch, maple and balsam. The axe has never touched these trees except to provide an occasional camp for some benighted bear hunter or lost angler, and examination shows that these trees are of immense age.

The hemlock which formerly abounded in this region and has been used so largely for tanning purposes has, with but few exceptions, been cut entirely, or almost entirely, from the valleys which are from 2,000 feet to 2,500 feet below these mountain peaks. It has not abounded nor has it been cut anywhere within many miles of the sources of the largest of the streams which rise in this mountain range.

In this range the following noted trout streams have their source, the largest ones, though running in opposite directions, having their sources very close to each other, viz.: the Beaverkill, Neversink, Rondout, Willewemoc, Esopus, Dry Brook and Millbrook.

For the purpose of calling attention to certain facts in regard to these streams I will first select the most noted of all of them, the Beaverkill, which has its source in the very heart of the Southern Catskill range, and runs for many miles before it reaches even the smallest clearing.

There are but few of the veteran anglers in this State who did not visit the delightful fishing retreat of James Murdock, which is situated on this stream, some twenty-five or thirty miles below its source, in the fifties; and all will bear testimony not only to the abundance of the trout but also to the abundance of the waterflow.

At that time this region was always visited during the latter part of May and the fore part of June with one or more severe northeast storms, which were largely or wholly local, and so regularly did these storms occur that the lumbermen could always rely upon what was generally termed by them the "June fresh" for the purpose of rafting their lumber from a point some twelve miles below Murdock's, at the junction of the Beaverkill and Willewemoc streams, down to the Delaware River, and thence to Trenton or Philadelphia, and they could also always rely upon the high water produced by these storms for the three or four days required for that purpose.

In 1859 I encountered one of these storms just after reaching Mr. Murdock's house. He immediately started off his rafts, and my brother anglers and I waited for some five days before the waters receded to such an extent that we could wade the stream. The next day another storm of like severity occurred, and after waiting for some five or six days and finding the stream still unfit to wade I returned home, having had but one day's sport in a trip of two weeks.

About the year 1863 I had a similar experience on the Rondout stream. A severe and sudden storm had raised the stream, and it was four or five days before the stream was fit to wade.

These are isolated cases, but they are in line with my constant experience between thirty and forty years ago. It was not low water then, but high water which was most feared by anglers.

On returning home from these trips, when we had been visited by these severe storms, it was found that they had not extended to any great extent either to the east or west of this mountain region, but seemed to be almost entirely local.

These storms were almost invariably followed by strong westerly winds which usually continued for two or three days.

All this is entirely changed. The storms which prevailed so frequently thirty or forty years ago seldom occur any more, and when they do the streams run down almost as rapidly as they rise. In 1891 I was on the Rondout Stream when I found that it was nearly bank full in the morning from the effects of a storm which had prevailed during the previous night and which was followed in the morning by the usual westerly wind. The stream ran down so rapidly that in the afternoon I found it possible to wade it, and in the afternoon of the next day it was too low for good fishing.

I have had the same experience in the Beaverkill, and have found within the last few years that not later than the second day after a storm it was in good condition for fishing, and on the third day too low for any satisfactory sport.

For the purpose of ascertaining whether the rapid depletion of the water in these streams commenced at their sources, or at the point where the land on the banks had been cleared, I made a personal examination of the Beaverkill some four or five years ago, within a day or two after a heavy storm, following the stream for several miles above the point where a tree had never been cut, and found that the water had run down almost to the drought level.

I have also found, by actual comparison, that these mountain streams have of late years run down quite as rapidly as the streams which in other places run through lands which have been cleared and drained from source to mouth, and I firmly believe that the experience of others will thoroughly coincide with my own in this respect, and if I am correct in my statement of the above facts, then I am forced to the conclusion that the cutting or destruction of the trees at the head waters of our streams is but one, and a very limited one, of the causes of their gradual drying up.

I suggest the following theory as accounting in part at least for the conditions above referred to. Years ago the lands lying west of this mountain range were very largely unbroken, the prairies were covered to a greater or less extent with natural grass, and the swamps in the low lands were undrained. Under these conditions the winds, which during that time largely prevailed from the West, were surcharged with moisture by reason of the gradual evaporation from the soil, the low lands and the swamps, and when these winds were forced up to a height of from 3,000 feet to 4,000 feet, the moisture was condensed into rain, and the mountain tops were saturated with moisture, which slowly and steadily through springs and rivulets kept up the water supply of the streams. During the last thirty years the prairies have been almost entirely reclaimed from their natural state, the low lands and swamps which furnished a large amount of moisture to the atmosphere have been drained, the rain as it falls sinks rapidly into the cleared lands, is carried off immediately by surface drainage, and as a result the atmosphere as it blows over these lands is no longer kept in its normal condition, or supplied with moisture from the soil through gradual and natural evaporation, but rather yields moisture to the soil to produce an equilbrium, and when this atmosphere reaches the mountains of this State and is forced up to the altitude of from 3,000 feet to 4,000 feet, the moisture which it contains is not sufficient to be condensed into rain, but like a dry sponge it withdraws or soaks up moisture from the soil in order that it may be restored to its normal condition.

The same is equally true as to the forests which thirty or forty years ago abounded in the States lying west of us, and which to a greater or less extent have yielded to the lumberman's axe, or have been destroyed that the land might be opened to cultivation. The amount of moisture which scientists tell us is evaporated annually from every tree is almost beyond comprehension, and in addition the destruction of every tree submits the soil, which had been protected by its shade and had yielded moisture by gradual evaporation, to the direct rays of the sun.

Does not the clearing of every acre of the original prairie, the draining of every swamp, and the cutting of every tree in the vast region of this country lying west of the water sheds of the State of New York, through which the earth is exposed to the direct rays of the sun, constitute an unit in the process of the destruction of the water supply of our streams, and if so, would not the planting of every tree constitute an unit of force in the opposite direction?

If there is any force in the above theory, and if it is sustained by the facts, then it must necessarily follow that our mountain streams are largely doomed, and that the preservation of the trees at or near their sources will but partially save them.

If this be true, it is to be hoped that the Board of Fisheries, Game and Forests in this State will check, so far as may lie in its power, the further cutting or destruction of the trees in the cleared lands and woods throughout the entire State, and use every effort in its power to foster a general spirit in favor of planting and preserving trees everywhere throughout the State.

IMPOVERISHMENT OF THE FOOD-FISH INDUSTRIES.

BY DR. BUSHROD W. JAMES, PHILADELPHIA, PA., MEMBER AND VICE-PRESIDENT OF THE PENNSLYVANIA FISH PROTECTIVE ASSOCIATION.

The time has come when the inhabitants of the United States must cease to look upon the lavishly generous gifts bestowed upon them by nature as limitless, and therefore needless of special care or protection. Wastefulness has been overlooked without fear of inevitable retribution, until the punishment is already upon us in more than one perceptible quarter. To that which relates to the impoverishment of the fish-food supply, I will devote the subject of this paper.

If we take the literal meaning of "food-fish" we must include every known animal product of ocean. river, or streamlet; for if possible, some species, which to our refined taste, are actually loathsome, are more important in their multi-usefulness than are many of those which we favor particularly with above mentioned name, and which our Fish Commissions are endeavoring to protect.

A universal impoverishment in the fisheries is making itself felt from Point Barrow all the way down the Pacific coast so that business itself in shipping is beginning to suffer. This was once very important in whalebone, whale oil, seal skins and walrus ivory, but it has so far deteriorated as to almost ruin the coast trades in this line, while more sadly still, the natives of the northern coasts and islands have been reduced to actual want through the wholesale destruction of the once plentiful supply of animal life so peculiarly fitted to meet their various needs. Without a natural supply of wool or cotton, those which they possess being obtained by trading, the fur seal furnished to them their most comfortable garments and, next to the pelt of the sea otter, their most valuable trading staple. The seal also bestowed upon them the oil which actually was the only substitute for the milk, coffee, tea or chocolate, without which we feel it would be impossible to enjoy our meals. The flesh rated second only to fresh fish, and so precious was it that not a particle was wasted. Now with those vast herds very nearly depleted or frightened from their breeding grounds, what must become of those people who depended upon them for the necessities of existence?

So with the whale and the walrus—greed of gain has so over-grasped until hundreds of the nation's wards must go hungry, houseless and scantily clothed, simply because individuals or corporations have endeavored to sweep into their hands the whole supply in a short time while prices were good. Now whaling vessels go and return unsuccessful, seals are already alarmingly scarce and walruses are rarely seen at all; partly because they are extremely cautious and shy, but in greater part because their tusks excited the cupidity of traders to the procuring of all animals, whether mature and perfect in ivory or not. We are rather too far away to hear the cry of distress among the inhabitants of the northwestern islands, but commerce now discovers the grand mistake, perhaps too late. A slight expression of anxiety in San Francisco gives rise to a demand for a greater protection of the finer salmon fisheries, which but a few years ago appeared to be inexhaustible.

This fish being delicate and a very desirable table food, doubtless the laws will be more effectually and carefully enforced. But the fishes, or other animal life or plants on which the salmon feed, must also be guarded from destructive depredation. Leaving the western shore of the continent, still another note of dismay is sounding from Maine to Florida! Salmon is rare in all our rivers; the great fishing banks of Maine and Massachusetts are failing; the lobsters are growing scarce and small; mackerel is almost gone from some quarters in which the "Look-out" has heretofore watched the coming schools and sent the joyous tidings to many an eagerly waiting fisherman. Herring catches in some localities are growing less and less; in some places the fishing smacks are laid high and dry because there is no longer special use for them. Some fishermen say that shad is getting scarce in some of our rivers; others assert that they, once so rarely flavored, are now at times tainted with coal oil and sewage or foul mud, and are consequently almost unsalable. And so the cry continues from shore to shore, while one of the most important industries of the country lies in jeopardy. Both the United States Fish Commission and the commisions of the several individual States have done nobly, so far as they have had prerogative, but there is still a vast amount of improvement to be made in fish protective legislation before we can feel assuied of preventive measures concerning fishing in the public waterways all over the land. A very apparent defect is instituted by conflicting laws made for the control of streams which run through two or more States, whereas, if each State would consult with its neighboring ones before maturing its laws regarding rivers and streams, and fishing therein, conjoint measures might be taken which would improve the local fisheries without injury to any one locality.

In my opinion, alert watchfulness is requisite, not not only during certain seasons, but at all times, if the product is ever to be elevated to its pristine quality and abundance. Common sense teaches that fish, as well as other animals, require a certain length of time to mature and become perfect for the food of man. It affirms also that when consumers discover that they are obtaining an inferior article, particularly if at a high price, they will soon cease to purchase the commodity, giving its place to something else, thereby creating a market which by-and-by may repudiate fish as a fashionable staple for food.

One of the first and most important safeguards to the fisheries is the cleanliness of the rivers in which they are found. Chemical impurities, as well as sewage, should be kept out of fishing streams entirely, or at least as far as can be made practicable, and facilities would soon appear if so required by legislation. Some chemicals may not be poisonous, others are, and they are therefore unfit to be eaten or drunk by fishes intended for food, either for man or for other fishes. I think there might be a feasible arrangement made by which the water from dyeing establishments, mills, factories, etc., could be spread over an extent of ground through which it could percolate before reaching the stream, thus depositing the maximum of poisonous matter in the earth. Possibly the food worms of the fishes might be destroyed, but the localities devoted to these industries are sufficiently limited to allow a much greater extent of land uninjured. The dangers of eating fishes who feed in streams polluted by sewage have not as yet been considered fully, but it is ably demonstrated that they are subject to very numerous parasites, some of which are not evil to mankind, while others are poisonous. More extensive and universal biological research, carried on upon strictly scientific principles, will soon make known the number and kind of dangerous parasites, and the waters which they infest, when the fish afflicted by them should be pronounced unsalable, and if no other plan can succeed in preventing their distribution, fishing in streams in which they are found should be prohibited entirely. That parasite growth is possible in fish, suggests the question whether they may not be attacked by the bacteria of diphtheria, the microbes of typhoid or malarial diseases, and even the bacilli of Asiatic cholera from drinking the river water near large cities which deposit all or a greater part of the sewage therein; if that be the case, may they not impart such diseases to unsuspecting mankind using them for food? Many people, especially the poor, eat fish and eels that are caught in lower streams whose waters are so far influenced by tides that they back up a considerable distance, yet the ebb is not strong enough to carry away the debris which they take up and deposit along the shores. This rubbish holds pools of water in check until they become stagnant, and sometimes dead fish are found imprisoned among branches, weeds, old barrels, baskets, etc. It stands to reason that any fish drinking the water or feeding in such places must become more or less subject to poisonous parasites, and thus become unwholesome for food; and if the flavor of coal oil, gas, tar and other impurities make themselves disagreeably apparent in their flesh, which is a well known fact, the probability of far more dangerous matter seems to become an incontrovertible certainty. By partaking of this infected fish, cholera and other epidemic diseases may be started in the systems of a few persons, and the contamination would spread in every direction, afflicting even people who never touch food fishes. I think, under these conditions, each State should have laws compelling the clearing and lowering of the mouths of all rivers or creeks in which the waters lie stagnant and restricted by rubbish; that each State Commission should have a biologist, who could make known the presence of dangerous parasites, and all who are interested in fish culture and protection should join in trying to discover whether there could not be some plan adopted to destroy them without endangering the life of the fish; that the food animalculæ should be as carefully protected as the fish themselves, and that all deleterious matter should be kept from them as far as possible. I believe all States, and especially those that have coast lines and bays, should so regulate the fishing seasons that the strong, mature and fertile fish may be allowed to reach the spawning places unmolested, or else that certain streams in every State shall be closed against fishermen every second year, thus giving them a whole season in which to spawn and multiply. While some are closed, others can be opened and so alternated that there will be no danger of exterminating the fine food supply. The reward in full-grown fishes of good quality would soon compensate for the sacrifice.

If these plans are not practicable then others must be adopted. Perhaps good results would follow if fish culture were made so universal that at the time of the running of the schools to the spawning grounds men were stationed at the mouth of or along every important river to catch the fish, obtain the eggs, and hatch them artificially; then they could be deposited in fitting places, after the season was over, and thus the danger of extinction would be over.

The present style of ocean pound-nets could be improved by making the meshes large enough to allow of many more fishes than can possibly get away now. Of course, the larger the fish the less danger there is of its being pounded to death by the others; therefore the mesh of the leader and pound-net should be so increased as to permit those of unmerchantable size to get free without injury to fins or scales. Fish weirs, or so-called eel weirs, largely used in inland streams, especially the smaller ones, should be entirely abolished by law in every State, as they are now in Pennslyvania; but if any State is unwilling or unable to procure such legislation, then all such arrangements should be legally constructed of such pliable material as to insure that the fish will not be so injured or bruised as by the present slat system. Would it not be practicable in such instances to produce screen of other material than wood, such as woven grass, canvas, or something which would not bruise the fish nor break the scales from them as they go through? If so, thousands of them would be saved from damage, which often results in deformity or deterioration, if not in death.

I am possessed of a keen interest in food fish culture and protection.

First—Because of their vast importance as the chief support of many thousands of inhabitants of this and other countries.

Second—That because through them may be promulgated disease, and the public health be jeopardized, because of the waters in which they abide becoming liable to contamination.

Third—Because of their great value as a staple commercial production of the country.

For these reasons I would earnestly urge fishermen and all those engaged in the trade to join with our American Fisheries Society in the endeavor to perpetuate the growth and quality of food fishes; and to this end a little self-denial will be found very advantageous not only to their personal business but toward the ultimate protection and continuance of our great interests at stake in fish as a commercial element.

Therefore, let the mackerel banks alone for a year or two, and perhaps they will again be abundantly populated.

Do not try to take all the best fish from the sea and streams at one time because prices are temptingly high.

Let the lobsters have a few years in which to attain their normal growth and quality.

Do not so far overstock the market with herring and other food fish that they will become a drug to the trade.

And let us hope that there may be some way by which we may obtain the right to protect the young herring which are now caught in the waters on our northeastern boundary, and canned under the name of "sardines."

If it is possible to regulate the salable size of each variety of fish so that those below that size will not be caught, let each one conscientiously regard the law.

Undersized or imperfect commodities always tend to disqualify even the better grades of the same; therefore, from a selfish point of view alone, every interested party should give earnest endeavor to favor any plan which points to improvement. Impoverishment has been the finale of nearly every production, and now the necessity calls upon the people and the entire government to provide ample legislation for the protection of all kinds of water animals, from the great walrus, whale, sea lion and seal of the Arctic and Pacific to the delicate brook and mountain fishes, all of which are valuable food for either human beings, other fish, water birds or lower animals.

Perhaps it is too much to expect the States which have not been subjected to a threatened insufficiency to join with us in our protective work at present. But this State and others which have taken up the important matter, must make the propriety of their measures so prominent, and the attention to every detail in legislation so consistent, that the result will redound to their credit and provoke a spirit of emulation in those who to-day are inclined to disparage the great commercial and financial importance which, we are convinced, is attached to the numerous fishing interests of the United States,

The objects and successes of the several commissions should be understood by the general public as well as by those closely connected with the fishing business, and with their knowledge will probably be very valuable aids to the commission, aroused in districts through which excellent streams pass. When they are convinced that unclean and unhealthy matter thrown into waters will probably produce disease-breeding fish, they will not place it there, and every individual effort will have a good influence upon others. My firm conviction is that even among the most careless people, ignorance is far more to blame than intentional destructiveness.

Let the consumer, and the man who obtains and supplies, come together harmoniously on the common ground of mutual advantage to remedy the wasteful impoverishments to which I have referred, as well as all others.

DISCUSSION ON THE PAPER OF DR. BUSHROD W. JAMES.

Mr. H. C. Ford started the discussion as follows:

"In regard to the pollution of the waters, so ably depicted by Dr. James, I respond that it is one of the most serious problems of the inland waters of Pennsylvania. I have endeavored to have laws passed, but through the intervention of large corporations, they have failed. Only this last year we endeavored to have a law passed, fixing a penalty upon tanneries, factories, bleacheries, etc., emptying dye stuffs into the streams, but representatives of the United States Leather Trust, assisted by ardent Tammany men, were too strong for us. In some States it is forbidden to allow refuse from saw mills to pass down the streams, but there is no legal way to prevent it in this section of the country. The fish in our Pennsylvania streams, I must say, in spite of all assertions to the contrary, are on the increase. Ten years ago they commenced to be protected and the young shad passed out of the river and went to the sea and were then safe."

"There is a regulation preventing the use of nets of a small size, and we have a law in Pennsylvania in the course of the shad season that no nets are permitted in the Delaware and Susquehanna Rivers, or in any other streams of the State. This has given the fish a chance to become mature. About five years ago, in 1890, 60,000 fry of salmon were deposited, and the fish ran up into New York State to get the benefit of the shallow and clear streams. They attained a length of nine inches up the river before coming down to sea, and remained about three years before returning. I had thought that the Delaware was too far to the

South to become a successful salmon river but this spring several hundred young salmon have been taken from the river, weighing 9 to 14 pounds, and I believe this will continue. In 1894, 500,000 young salmon were deposited in the upper river, which will return in still larger numbers. It is principally as a shad producing river that the Delaware is successful. The Susquehanna River at one time excelled the Delaware. Throughout Maryland the fish are disappearing, because fish baskets are legalized, and these have killed the young shad deposited in the upper part of the rivers, and these have decreased since a few years ago. This shows the protection afforded to the Delaware, and the value of re-stocking that river."

Mr. Henry H. Lyman, of New York, said:

"The dissemination of disease by eating fish from polluted streams impresses me that along that line great interest might be awakened among the people who take their drinking water from these same streams, and thus in remedying this, help along the matter of the preservation of the fish. As you know there are many rivers in this State that are supplying drinking water to large numbers of people, and in these same streams fish are being poisoned to death by deleterious matter thrown into the streams. I live on such a river, and many factories along the banks are daily depositing unhealthy matter in the water. My idea is to practically bring the question before the people in such a manner that they will realize that their lives are in danger, and have a law passed to put a stop to these practices, and thereby accomplish our purpose as regards the fish."

"The trouble in awakening popular interest in years past, as to the proper protection of fish has been, that fishing was considered as a sort of fad among sportsmen, rather than of vital importance to the people themselves. I have watched the thing in the State of New York, and I believe that this sentiment is changing. It has been helped along by the action of the Fish Commissioners and Governor Flower, and with his assistance will be successful. The people are now taking hold of the idea."

"Years ago the salmon came into Salmon River in such numbers that they had to be thrown away, and white fish were caught in quantities, 10,000 to 15,000 in one net. That industry has all gone; the fish have been all cleaned out by imprudent fishermen."

"We must create a sentiment which will again see the restocking of those lakes and those waters by natural production. Put in a few thousand or a few million fry, and combine with this course a protection that means protection. We cannot get it by forming clubs along the way, but we must get legislation and foster a sentiment favorable to protection. A sentiment of protecting the food fish draws attention to this fact. Now they are taking hold of it through the influence of this sentiment I have mentioned. The people are taking hold of it; the Sheriffs are taking hold of it to enforce the law because the people see in it an element of benefit to themselves and not merely for the fly fishermen and the sportsmen."

"We have a recompense in the fact that pike, and silver pike and other fish come into the river that could not get in five years ago on account of the nets."

"It is right that we people interested in the fish business of the Great Lakes, which has been a great industry in the past, and may be in the future if not wiped out by greed, should meet together. We have much in common. We must prevail upon the legislatures of those States to do something in the same line along the lakes, or we shall accomplish nothing, for if the State of New York passes a law that will close the season in Lake Ontario, the fishermen will go to Lake Erie, and if a law is passed affecting that, they will go to Lake Huron, and so on, so you see that we must take some course of action that will bring about unity; some movement of the legislatures of the different States that will accomplish something like unity of purpose the whole length of the States."

THE DISTRIBUTION OF THE TROUT FAMILY.

BY W. D. TOMLIN, DULUTH, MINN.

It has become accepted as fact, that no member of the Salvelinus, Namaycush, or Iridea family, have their habitat in what is known as the Mississippi water shed.

All the cold spring streams of the St. Lawrence connections, clear up to the Canadian boundry line, are expected to contain trout, and have at some time been considered good trout streams; while the Namaycush family are found in abundance in the lakes scattered along the streams connecting with the aforesaid St. Lawrence. This subject has been much debated because gentlemen have said: "such a thing could not exist!" but the proof of the fact is beyond all dispute; the Namaycush, or Lake trout, are found in the feeders of the Mississippi, and are caught weighing from two to thirty pounds each.

They are a beautiful and considerable gamy fish, when caught below five pounds, and will take a spoon hook even to the highest weight known.

Up beyond Grand Rapids, Itasca County, Minnesota, and running almost close to the Rainy Lake water shed, there is a large lake named Pokegama—(pronounced Po-keg-ama, the o sounded softly)—about fifteen miles long and three to five miles wide, a deep clear water lake fed by abundance of springs. In this lake splendid specimens of the large lake trout known as the Mackinaw trout are often caught, and give the toiling land-looker and settler a dinner of a fish not to be despised. That they are certainly trout, needs but the proof of men who have lived in Michigan where the Mackinaw trout can be had at almost any time at the hotel tables.

Mr. John C. Howard, of Saginaw, engaged in the lumber business before moving up to Grand Rapids, has caught them frequently, and often while in the woods, and his supply of meat has run short, simply took a spoon hook from his pack and getting into a canoe, has trolled but a little ways and caught a fish sufficient in size for a supper for three men.

Captain Joseph Crowther, operating a steamer on the upper Mississippi, knows the lake trout thoroughly, and catches many of these fishes every season in Pokegama lake.

A short distance east of Pokegama, is another lake, named Trout Lake, from the fact that such numbers of beautiful lake trout are caught there. In January, 1895, while visiting at the hotel, Grand Rapids, one was caught through the ice, and brought into the village, weighing about seventeen pounds, a splendid fish and having all the marks of the Superior lake trout. He was caught with a piece of bacon, cut like a strip from a fish, and sunk through the ice.

In March, two were caught weighing about three pounds each, as handsome as the proverbial beauty—the brook trout—they could not be bought, as the gentleman bringing them to the village had them carefully packed to send to a sister and brother-in-law, who scouted the idea that such trout could be found up in that country, and in streams or lakes whose natural water shed was the Mississippi river.

It is a matter of regret that these splendid fish are decreasing in numbers, but the fact has ceased to be disputed that these fish are genuine trout, the question arises, how came they in the waters, so far from streams or lakes, having any direct connection with Lake Superior waters?

Andrew Slater, who lives on Tyndall's farm over at Pokegama lake, brought in a lake trout to-day, weighing thirty pounds, that he caught with a spoon hook, beween the Tyndall place and Bender's point. It is the finest trout ever hooked in these waters.

Several fishermen tried the Trout lake fishing again last Thursday with but indifferent success. It has not proved to be a very good year for lake trout fishing.—*Grand Rapids Review.*

EPIDEMIC AMONG TROUT IN NEBRASKA.

In May, 1895, a serious loss of brood trout occurred in the ponds at the State hatcheries of Nebraska. This was made the subject of the following letters to the Secretary of the Nebraska Fish Commission, by Superintendent M. E. O'Brien:

BOARD OF FISH COMMISSIONERS,
State of Nebraska,
State Hatcheries, Omaha, May 3d, 1895.

MR. JAMES B. MEIKLE,
Sec'y Fish Commission,
Omaha, Neb.

Dear Sir:

I sincerely regret to have to report to your Honorable Board that an epidemic has broken out among our trout, that is causing them to die at an alarmingly rapid rate. The first time that I noticed anything wrong with the trout was about the 20th of March, when we found four dead trout in the ponds. A few days after we found ten dead trout, and two days later fifteen more. At this time the ponds were getting quite foul with the green scum or "conferva" which forms in the ponds every spring, and concluded that this was the cause of the fish dying. I immediately put the men to work cleaning out the ponds, drawing off the water from each pond separately, and raking out the leaves and scum and rotten vegetation. During the time this work was going on the fish were dying at the rate of twelve or fifteen a day. This was considerable of a surprise to me as nothing had ever happened before in all my experience; however, I argued that as the ponds were cleaned out and the water settled that the fish would be all right again, but in this I was mistaken, for the fish continued to die as rapidly after the ponds were cleared out as before. This, to me was unexplainable, as the fish to all appearance were in a good healthy condition, showing no signs of the fungus of the cottony sort, which follows an injury to the skin, but they continued to die with alarming regularity. I then hired extra help and put them to work cleaning out the mud that had accumulated in the bottom of the ponds. We went through four ponds, shoveling out all the mud and decaying matter, leaving the ponds as clean and free of all injurious matter as on the day they were first completed; but all this work was apparently of no avail, as the fish continued to die. We then handled the fish over again giving them all a salt bath, which is a sure cure for parasites, but this did not appear to do much good. My latest experiment is to stop feeding liver and feed the fish on maggots and minnows. I do this in the hope that a change of food may do them some good. We have lost so far about eight hundred trout from one-half to two pounds in weight, and we are still losing fifteen or twenty fish a day. In all my years of work in fish culture this is the most peculiar and annoying experience that I have ever had, and I sincerely hope that I may soon discover some remedy which will prevent the further ravages of the disease that is so rapidly decimating our stock of trout. I had hoped when I made this report that I would be able to say that the danger of further loss from this unknown disease was over, but unless my latest experiment proves successful I will be at a loss what to do next, as I have almost exhausted my resources.

Yours respectfully,

M. E. O'Brien.

Board of Fish Commissioners,
State of Nebraska.
So. Bend, June 1st, 1895.

Mr. James B. Meikle,
Sec'y Neb. Fish Commission,
Omaha, Nebraska.

Dear Sir:

On May 3rd I notified your Honorable Board of an epidemic that has broken out among our trout, that was causing the loss of a great many fish. In my report to you at that time I explained in detail the manner in which we had treated the fish, and that all our efforts to stop the ravages of the disease had proved unsuccessful.

I am pleased to say that we now have the disease under control, and the loss of fish is stopped. From a close observation of the disease and from experiments that I have made, I am convinced that the disease was caused by feeding diseased or poisoned beef livers. My reason for coming to this conclusion is, that from the time the disease first appeared among the fish up to the time we stopped feeding livers, I had tried every known remedy without avail. During this time I had watched very closely the actions of the fish and noticed that a few hours after feeding the fish would die very rapidly. When we stopped feeding beef livers, and began feeding live minnows, it was some days before the death loss among the fish was perceptibly lessened and in about twelve days it ceased altogether. Then I began to experiment by feeding the fish in a certain pond on beef livers, and the fish in the other ponds on live food. The result was that the fish fed on the livers would begin dying within twenty-four hours, while there was no loss among the fish fed on the live food.

I followed this experiment up until I had gone through each pond separately, and in every instance where the fish were fed on livers it was followed by disastrous results, and a change to the live food, minnows and maggots, always affected a cure. The peculiar part of this is that all the trout that we have in our ponds have been reared on beef livers, and up to the breaking out of this epidemic they have always been perfectly healthy. A further investigation may reveal the cause, but I must admit that it is a mystery to me at present.

On May 6th, in compliance with instructions received from the Board, I sent specimens of the diseased fish to Dr. Tarleton H. Bean, U. S. Fish Commision, Washington, D. C., to Mr. Fred. Mather, Supt. Fish Hatchery, Cold Spring Harbor, N. Y. and to Professor Bessey, of the Nebraska State University. The first sent to Dr. Bean were examined by Mr. Herbert A. Gill, Acting U. S. Fish Commissioner. Mr. Gill says that a similar disease appeared among the fish in the ponds at Northville, Mich., last year, and that the disease was cured by giving the ponds a thorough cleaning, drawing off the water, leaving the dirt exposed, covering it with lime and salting it. This treatment effected a cure and the fish have not been attacked since. Mr. Gill writes that in the way of direct treatment he knows of nothing to recommend. Mr. Mather writes that the disease is probably the same that occurred among the fish in the ponds at Cold Spring Harbor in 1890. which lasted for a period of three months, and caused the loss of a great many of their fish. Mr. Mather is of the opinion that the disease was caused by feeding tuberculous beef livers. He said: "I have changed butchers and have had no trouble since."

Prof. Bessy does not know the cause of the disease, and cannot suggest a remedy. From the reports of Mr. Gill and Mr. Mather, and from my recent experiment, I am constrained to believe that the disease is the direct result of poison, which may be in either the food or the water, and once a fish is affected by it there is no cure, the only remedy is to remove the cause.

The first indication of the disease in a fish is a white spot, usually on the side, of about an inch in diameter; within a short time a hole would appear in this and shortly after the fish would die. Upon examination would be found that under the white spot was a patch of dead and decomposed tissue, and on the slightest pressure this would spurt out a dark fluid. This cancerous growth was more fully developed in some fish than in others. In some of the fish that died the only sign of a disease that I could discover was small red pimples on the under side of the gill cover. Fish that were attacked in this way would be suddenly seized with a spasm or giddiness, and would rush about the pond on the side for a few moments and suddenly give up the ghost. Hereafter whenever this disease appears among the fish we will be better prepared to handle it because of our experience of this season, and we need not fear any great loss from this cause in the future.

Yours respectfully,

M. E. O'Brien.

DISCUSSION ON THE EPIDEMIC AMONG TROUT IN NEBRASKA.

Mr. Mather: "Having had experience with something of this kind in 1890 and '91, accounts of which will be found in the New York State Fish Commission Reports for 1891-'92, I will say that such things occur somewhere almost every year. The Wisconsin Commission had a great mortality about that time, and this year the catfish in Monhagen and Highland Lakes, in Orange County, N. Y., are dying by the ton, and the shores are covered with them to such an extent that men have been employed to cart them away. I have several letters from residents of Orange County asking for the cause of this mortality, which of course I do not pretend to know."

Superintendent O'Brien, by advice of Commissioner May, of Nebraska, wrote me under date of May 6th, 1895, as follows:

MAJOR FRED. MATHER,

"My Dear Sir:—During the past month a disease, which is new to me, has broken out among the trout in our ponds, and a number of them, weighing from one-quarter to two and one-half pounds have died from it. In looking over the reports I find that you mention such a disease in the ponds under your charge, and from your description it appears like that which is killing our trout. In order to be certain of this I have shipped you by express, to-day, four of the trout taken dead from our ponds, that you may examine them. Kindly advise me if I am right in my surmise that it may be the same disease, and any information that you can give me on this subject, the cause, its final effect in your ponds or the remedy, will be fully appreciated.

Very respectfully,

M. E. O'BRIEN."

"I have no copy of my reply to Mr. O'Brien, but said, as near as memory serves: 'The trout came to hand, but the ice had left, and the fish were in the condition of "rare-ripes," very soft and bad odor. The ulcers look like those on our fish, but in each case were on the head or the opercle, while my fish were mainly affected on the body, seldom on the head.' After my report was published, I think, I learned the cause, and believe it to have been diseased food We were feeding beef livers and I had noticed many cases of tuberculosis in them. They came from a firm near 44th Street and 1st Avenue, New York City, and I raised a row about it, and gave orders to the man who fed the fish not to feed a diseased liver, or one that he would not eat himself, excepting only those which might be a little sour, as this condition seems harmless. When the disease broke out I watched things closely and found that instead of burying the diseased livers he had thrown them in the harbor, through laziness, and my neighbors were complaining that they drifted upon their shores. He had also cut great tubercles from some livers and fed "the good" parts. As I could not well inspect every box of liver, as business called me away often, I was surprised to find how many diseased livers had been sent, and incidentally, how much diseased beef must have been eaten in the city. On learning this, my first action was to discharge the man who had fed the diseased livers, and the next to find a reliable butcher who would not send livers affected with tuberculosis."

"Since this we have had no ulcers on the trout, and this is the first time that I have made known what I firmly believe to have caused our great loss of trout in 1890. Just how far other "epidemics" may come from similar causes it is impossible to say, but that diseased food was fed to the fish without my knowledge, I think will be accepted as sufficient cause for an epidemic."

SOME OBSERVATIONS ON THE MORAL PHASES OF MODERN FISHCULTURE.

BY HERSCHEL WHITAKER.

Mr. Whitaker, before reading his paper, made the following remarks:

"Of course in a paper like this, it is impossible to give you anything like an adequate conception of the basis worked on in the Lake region. I do not know how many, but a very great many pounds of white fish measuring from eight to nine inches were salted and sold as herring, or smoked and sold. If these had not been molested, but were allowed to remain in the water three or four years, they would have been of greater value. We have had since 1891 a statistical agent every year, and his reports are very reliable, and taken by the same man every year. His report for 1892, which was the last year statistics were collected, show that fully one-half of the fish taken and marketed were number twos and under. You know what that means. Two-thirds of the catch in weight of the fish taken in the waters of Michigan were all of that size. Now it is impossible unless some general action should be taken, that the fisheries of the Lake will last long. It is within my memory quite a while ago, something like 35 years ago, I remember distinctly in Lewis County in this State (New York), where I was born, it was a common thing for the farmers to go to Sheboygan Bay and other points on Lake Ontario with their wares in November and bring back white fish and salmon-trout and distribute them."

"The question is what are we to do? If we can secure aid from the Legislature, we may accomplish something or this work ought to be abandoned. If the people living in the States bordering on the great Lakes have no regard as to what becomes of the fisheries, I do not know why we should lie awake nights waiting for the time to come, if it is the desire of the people that the Lakes should be fished out."

"It is not said in the spirit of pessimism, but in view of the facts in the case, and I am only too glad to know that Wisconsin has taken some action in this matter, and I believe that the new Board is going to give that Commission a new lease on life. We are too content to sit down and let matters take their course. A Commission always marks out a course of policy. It must not be content to put into the waters a lot of fish, but it must give protection. I have the pleasure to say we have recommended that resolutions be passed for the last six years that this be done. The duty of Commissioners is to hatch and plant fish; the duty of the Legislature is to protect the fisheries. I have hopes that we shall have such laws passed. He says we have it. They adjourn without giving us any encouragement whatever. As an instance of what becomes of our white fish: in 1892 our State did not obtain from Lake Michigan but 3,592 pounds of white fish; in 1895, 19,500 pounds were caught. Every man that had a pound net stored away took it out and caught these little fish and sold them. Fishermen tell us that the planting has renewed the fish. 'Why, how do you know it?' 'We take in a school of fish all of the same size."

"Discouragements we have to meet, and we hope that the expression of this Society will be towards the protection of the rights of the fishermen and the interests of the people."

Whoever said that "Revolutions never move backward," would never have given voice to any such sentiment had he lived in America in the year of grace, 1895, and been interested in fishculture. Charity for the utterances of another might incline us to say, that he said it with a mental reservation perhaps, or that what he meant was that while revolutions never moved backward, they seemed at times to do so, only to gain added force with which to throw down with resistless energy final and seemingly insurmountable obstacles. If this qualified interpretation were not true, the fish-culturists of this country, and especially of the Great Lake region, might be well cast down in spirit and hopelessly disheartened by an important event of the past month.

On the 24th day of May, 1895, the Department of Marine and Fisheries of Canada, issued a notice that the order made in Council some years since, making the month of November (which is the spawning season of the Salmonidae) a close season for netters in Canadian waters on the great Lakes was revoked, until such time as the governments on the American side see the necessity of protecting the fish and are ready to co-operate in the work. The effect of this order meant a notice to the Canadian fishermen that until further notice they could join their American fellow-fishermen in working the final destruction of the commercial fisheries of the lakes.

The Canadian government exhibited wisdom in making the original order. The reasons for its promulgation were founded on the experience of years of observation of the pernicious and ruinous effect of the practices of the netters on the lakes. The enforcement of the order was wholesome and resulted in better fishing in their waters than in ours. Ever since the order was given effect, the Department of Marine and Fisheries has sought by every means in its power, to urge upon those entrusted with the passage and enforcement of laws for the regulation of the fisheries upon the American side of the waters, the necessity of a co-operation with them in the passage and enforcement of a similar act. They have had occasion to feel disheartened at the result. They have had further to bear the importunities of the lake fishermen of the different provinces and the petty politicians for a revocation of the order, because the States bordering the lakes upon the other side permitted their fishermen to fish at any and all times and with all sorts of devices. And so, at last, the order has been revoked—in a spirit of weakness, perhaps—until such time as the States shall see fit to join the Dominion in an effort to protect the fisheries.

No action, either public or private, concerning the fisheries of this country, has ever been taken which may be more pregnant of evil, or perhaps of good result, if we shall profit by the lesson, than this order of revocation. The result must depend on the future action or non-action on the part of the States whose territory is co-extensive with that of Canada on the lakes, in moving for the preservation of the great lake fisheries, by the passage of just and reasonable laws controlling the fishermen. While the action of the Department of Marine and Fisheries is one to be deeply regretted it has been, perhaps, in a measure justified by the absolute lack of co-operation on the part of the bordering States in meeting the Canadians upon this question in a spirit of fairness, and with a desire to protect the public's interests.

Two principal causes have contributed to the destruction of the fisheries of the Lakes.

1. The wanton destruction of small immature fish, and

2. The netting of gravid fish upon their spawning beds.

For three-quarters of a century these waters have been fished persistently, in and out of season. The size of marketed fish has been constantly diminishing, and the meshes of the nets have as gradually been contracting in size to accommodate them to the size of the fish. They have been fished for in deep water during the spring and summer months, and with the advent of the fall the fishermen have resorted to every known spawning bed and shoal, with every engine of destruction at their command, and played havoc with the spawning fish. What may reasonably be expected when an industry is thus prosecuted? Is there cause to hope for any reasonable measure of success from plants of fish made under such conditions? Not only are the fish naturally hatched thus taken and marketed of an immature and barely marketable size, but those which have been artificially hatched and liberated are also taken before they have had a chance to aid in a natural way the restocking of the waters, thus supplementing the work of the Commissions. Add to this the indiscriminate slaughter of the spawning fish upon their beds and how long can the industry survive? The answer is before us.

Ontario, with its former wealth of fish of the finest edible character, has long since been robbed of its treasure, and the nets of the fishermen have rotted on the shore. Erie, even richer than Ontario, in fine food fish is nearing its last stage, as was demonstrated during the season of 1894, by the exodus of the commercial fishermen from that Lake to the Lake of the

Woods. The Lake Michigan fisheries have been in a large measure ruined, and fishing in many localities on that Lake has ceased to be an industry to be followed with profit. Huron and Superior have suffered seriously from the same causes, and unless prompt and efficient steps are soon taken by the Legislatures of the Lake States these lakes, with the rest, will be robbed of the white fish, salmon trout and herring. Then will gradually follow the extermination of the coarser varieties of fish, and when the last remaining school of fish shall be sighted by some greedy fisherman who is "*following his business*" every netter on the Lakes will join in the pursuit of the last schools and when they are finally captured they will be found too small even to grade as No. 3s, Chicago inspection, and they will be strewn on the shore to "lard the lean earth" as fertilizer, as many of their kinds have done heretofore. From then on the Lakes will serve only as great highways on which to float the product of the prairies of the further west; they will be barren of the wealth of food they once possessed, and the Legislator may then, unless too busily engaged in gerrymandering Legislative and Congressional "deestricts," turn his attention to such passing affairs of interest as the devising of ways and means by which the fisheries of the Lakes may be restored to a productive condition.

A more selfish or senseless prosecution of an industry has never been witnessed in any age or country. With the exception of here and there an individual, the fishermen, never extended the hand of co-operation to the State in its attempts to restock the waters. We are met on every hand and at every step by their selfish greed. If we try to secure the ova of fish for artificial propagation the State must pay for handling the fish and the weight of the ova, and pay well. When the fish are to be planted they must be taken to the localities where they are liberated on the tugs of the fishermen, who reap the first and greatest pecuniary benefit for their capture. Will he do this share of the work without compensation? No, he charges his price even for the planting; Shylock takes his pound of flesh even though it is from the heart.

When legislation is proposed for the protection of the fisheries, the fisherman is found arrayed against it, and his main argument is that it is *an interference with his business!* Is it? What is his business? To whom do the fisheries belong? Who has been striving for years to bring back the fisheries to something like their original fruitful condition by the liberal expenditure of money? It is the State in the interest of its people. The waters belong to the public, and their rights in the fisheries are paramount to that of the individual fisherman. The fisheries are theirs and whoever exercises the privilege of fishing therein does so by the sufferance of the public, and under implied understanding that he shall not prejudice the public rights therein. The fisherman in the prosecution of his business is enjoying a *privilege* and not a *right*, and he is entitled to enjoy that privilege so long as he exercises it with a due regard to the paramount right of the public to have them preserved for the future, and no longer. When he goes beyond this and threatens the very existence of the fisheries by his acts he should be called to a halt by proper laws, the same as any other transgressor against public rights.

The statistics of the commercial fisheries of Michigan reflects the condition to which the fisheries have fallen all over the great Lake system, and it may be worth while in considering this matter to briefly refer to them. The number of nets fished in 1885 was 25,893, in 1891, 36,514, in 1892, 38,283 and in 1893, 42,073.

The total pounds of white fish taken in 1885 was 8,143,626, in 1891, 8,110,387, in 1892, 6,347,535, and in 1893, 5,345,800.

There was an increase in the number of steam craft engaged in fishing in 1891 over 1885, of 20 per cent.; in 1892, of 5 per cent., and in 1893 of 26 per cent.

Of boats engaged in the fisheries, other than steam, there was an increase of 94 per cent. in 1891 over 1885, of 54 per cent. in 1892 over 1885, and of 91 per cent. in 1893 over 1885.

These figures show that while there was a large increase in apparatus and boats during this period, there was an alarming decrease in the quantity of fish taken.

The causes contributing to this decay have already been alluded to, but a word further may properly be said on the subject. Since 1830 the Lake fisheries have been prosecuted with ever increasing ardor. The profits arising from the industry have been large, and the greed of the fishermen has "grown on what it feeds on." The introduction of the pound net marked the beginning of an epoch of rapid decay, and this engine of destruction, while not solely responsible, is largely so, for the rapid depletion of the waters. The erection of freezers at many of the Lake ports has also tended to the same end. They have made it possible for the fishermen to take every fish he can in the warmer season of the year, and preserve them by refrigeration until a more favorable market is presented when he can dispose of them to advantage. In fact it has made fishing profitable the year round. The result has been that the only protection afforded the fish has been the brief respite afforded by the severer winters when nature closes the lakes with a shield of ice, and when the fierce autumnal gales have swept out the nets. At all other seasons of the year the fishermen are pursuing the fish; in summer in the deeper waters and in the fall months upon their spawning beds, where the fish, attracted by that instinct of nature, the reproduction of their kind, seek favored reefs, gravid with thousands of embryos, to spend a brief season, and are met with every engine of destruction in every locality where the fishermen can set their nets for their capture.

Twenty-five years ago the fisherman was content to capture and market white fish of a weight of from three lbs. upward, but his eager and continued pursuit of the fish soon began to tell, and fish of the larger size began to disappear. Since then the history of the fisheries has been that of a gradual decrease in size of fish and a corresponding contraction of meshes, until thousands of fish are taken too small to be of merchantable value and they have been ground into fertilizers and strewn whole on the fields to enrich the soil.

The white fish does not spawn under two lbs. weight, and bearing this in mind a perusal of the Chicago Rules of Inspection of white fish, which practically regulate the white fish trade of the lakes, may not be without interest. Under that inspection merchantable white fish are graded into three grades as follows:

Standard No. 1 Whitefish shall not be less than *one and one-quarter lbs.* dressed weight, nor less than twelve inches in length. Standard No. 2's shall not weigh less than *three quarters of a lb.*, or measure less than ten inches. Standard No. 3's shall include *all fish under ten inches in length, and weighing less than three-fourths of a lb.*

It would seem to a man of average understanding, after a glance at these rules, with a knowledge that spawning fish are killed during their entire spawning season, that he need look no further for the causes of decay of the lake fisheries. "A candle cannot last long burning at each end." The owner of the goose that laid the golden egg, discovered too late that he had killed his goose to no avail, and so will the inhabitants of the great lake region, unless they shall insist upon prompt and reasonable legislation to protect their fisheries, will find all to late that they have calmly stood by and permitted the fisherman to gratify his greed, with a full knowledge that the result must be to rob the waters of their treasure.

The attention of the legislature of Michigan has been repeatedly called to the facts above recited, and to the necessity for legislation. They have been interviewed privately and addressed publicly on the need of legislation, which should arrest the practices now fast destroying the fisheries, and while now and then they will admit privately the force of the argument, protective legislation has so far failed. Legislators of fair intelligence admit privately that these practices are wrong and vicious, but in the same breath assure you that their constituents insist that they *must not be interfered with in their vocation*, and as the average legislator has his personal ambitions for the future, he weakly succumbs to the influence of a handful of fishermen in his district, and subordinates the public interest to his personal ambition. If the effort to protect the fisheries is to be pursued further, and we insist it should be, it must be fought out on other lines.

As honest men, charged with the responsibility of looking after the public interest in the fisheries, we must admit that it is idle to put into the waters, year after year, fish which will be captured before they are fit for market or have had a chance to spawn. Nothing can be gained by such work, not even credit for successful work, which is the only compensation most of us receive or ask, and it is a useless expenditure of public funds. Had we not in Michigan lived in the hope that each succeeding legislature would pass the legislation pointed out as necessary, we should long ago have recommended that the hatching of commercial fish be dropped.

What then should be done? In our opinion every state and government engaged in the artificial propagation of commercial fish on the great lakes should agree to discontinue the work until the fisheries are given such protection as will insure results of benefit. Fish culture has its uses, but if the object for which commissions are created, viz.: to restore and maintain the fisheries, is to be met with methods which give it no chances of success, further planting should cease until a more enlightened public sentiment shall demand the correction of existing abuses, or until the public pulse has been sufficiently quickened to the necessities of proper regulation to demand the passage of just restrictive laws.

It seems to me it is entirely within the province and duty of this society to put itself on record upon such an important question as this, as upon all other kindred questions affecting the fisheries. I believe that the seal of condemnation of this society, which is largely composed of fish culturists and of those who sympathize with our purposes, should be placed upon everything which hinders or defeats the success of fish culture. The lake states are not alone concerned in this question. Immense quantities of white fish and salman trout are sent from the lake ports all over the United States, they are found upon the bill of fare of every first class hotel and restaurant in the land in their season, and the destruction of these fisheries means the elimination of a wholesome food from the table of all.

But above and beyond all this there is involved a moral question in which fish culturists are concerned, and one which cannot be ignored. As commissioners we must not allow our judgment to be overcome by a desire to hatch and distribute more fish than our neighbor, simply for the credit which may be derived from a printed record, regardless of the fact whether the fish thus planted are liberated under conditions warranting any hope of success. We must remember that we are not alone fish culturists, we must further remember that we are citizens who are interested in a proper application of public funds for the benefit of the whole people, and we should see to it that public funds are not diverted into channels where. by the natural and artificial conditions surrounding them, it is clearly apparent nothing or but little can be expected in return.

There was a time in American fish culture when it was honestly believed that restocking by artificial propagation, without any other intervention, would restore depleted waters. But that time has passed, and we know after an experience of years, that common precautions are demanded of this enterprise as of all others. We, of the great lake region, have had forced upon us the fact that while to-day we are planting millions of fish in good condition in the lakes, we are hopelessly handicapped as to the results by the war of wanton destruction waged upon the fisheries by the netters, who say we will take fish in season and out of season, we will take them by any and all kind of devices, and nobody must say us nay, it is a matter of no concern to us whether there are fish for those who come after us; after us comes the judgment.

If by concert of action in the direction I have pointed out we can secure legislation which shall properly protect the work we are doing, the right of the fisherman to prosecute his calling will be open to him for eleven months of the year under proper restrictions, his business in the end will improve, the public will be assured of a continuing supply of good and cheap food, the Canadian government, I am confident, will be willing to restore the conditions it has just withdrawn to protect the fisheries, and as honest men we may renew our efforts to restock the great lakes with a certainty of successful result.

DISCUSSION ON THE PAPER OF MR. HERSCHEL WHITAKER.

Mr. Peabody, of Appleton, Wisconsin, took up the discussion as follows:

"While I do not entirely agree with the pessimistic view Mr. Whitaker takes of the evils of the Great Lakes, I will say that the question is a grave one. Mr. Whitaker comes from the same part of the country that I do, and our interests are mutual."

"Last October, together with others, I made a tour of the lake region adjacent, and where there formerly were found white fish, trout and pickerel, now the fishing is almost entirely destroyed. Within the past twelve years hardly enough fish has been taken to pay for the netting. The Commissioners of the State have been planting fish in Green Bay, and on our trip up the Bay last October, we interviewed the fishermen along the line to get at their views regarding the restocking of the waters, and we found that these net fishermen, (I do not look upon fishermen with a great degree of fondness; they are a sort of pirates as a rule), but these men are all of them anxious to see that proper legislation is obtained to protect the white fish on these shores, and they said to us that on account of the planting by the Commissioners in that year, they lost $20,000, and one man lost $6,000, and because of that they hope to get legislation which will protect the white fish in their own waters, and one of the points to be considered is that it is illegal to catch white fish weighing less than one pound or one pound and a quarter (I do not recall exactly which)."

"The fishermen's nets, boats and vessels are inspected, and not only that, but the men are required to give a report of the fish, as to quantity, variety and size. They have to make this report to the Commissioner. We have a very fair law; how it will work I do not know, as it goes into operation for the first time this year. Touching the fact of taking fish at the mouth of the Fox River, which has been one of the great white fish points, it is not uncommon to take pike, weighing 6 to 7 pounds and down to 3 or 4, but fishermen have caught fish weighing one pound and under. One fisherman said he had an order for one barrel, the standard weight to be half a pound, and he was unable to fill the order. We have in our new law a measure that precludes the catching of these small fish, or of taking fish within two miles of the mouth of the river, so that they will have the opportunity of propagation."

"While we were up this bay, I met a dealer in fish from Fulton Market, New York. He succeeded in buying a car load of fish and shipping it to New York. Happening to go there shortly after, I noticed on the bill of fare in a restaurant where I took lunch, "Brook Pike". I ordered some, and had one about six to eight inches long that looked very much like our Rock Pike. I asked the man where he bought his fish, and found that they came from this same dealer, and was one of the lot from Green Bay, Our present law imposes a large fine upon any transportation company taking out of the State packages of more than 20 pounds in weight, which includes pike, bass and trout, which will largely put a stop to that.

"I know we are on the high road in our State to check this wholesale draining of the public waters, and the legislature has very fairly met the demands of the Commission and their requests for this sort of legislation, and we hear reports from the public all over the State encouraging the enforcement of the laws, and while I am speaking I want to say that members of our commission are very much interested in forming fish and game protective societies throughout the State, and have succeeded in establishing six in as many different counties. We propose to have not less than one in each county, and more than one in some counties. We ought to have local organizations for the protection of the fish. I believe in a local sentiment, and the only way to have it is to crystalize it in the form of associations; and, I think, if the Fish Commissioners of the several States will work in unity, especially in the States bordering on the Great Lakes, we can adjust our legislation in such a way that it will equalize itself and be of great value."

Mr. Titcomb, of St. Johnsbury, Vt., asked if the law mentioned by Mr. Peabody restricting the weight to twenty pounds of fish shipped from the State had been passed, Mr. Peabody replied that it had not been passed, but the transportation companies had given instructions to their employees to that effect.

Dr. Bean, of New York, said ;

"Mr. Whitaker's paper set me to thinking about the relation of fisheries to fish culture. I have already mentioned the abundance of shad in California, which is a case in point. The first plant of shad was in 1872, and in 1880 the shad had become so abundant that many bushels of the young were sold for herring. People asking for herring were offered these shad. Shad are now very common in the market of that State. There being no regular fisheries for them, they are afforded a sort of protection which has proved effective. They are caught only in salmon nets of about eight inch mesh. Only large fish are taken, so with the small demands of the fisheries and the protection of the young fish, by recent legislation, you have the result as it appears in California to-day."

THE WORK OF THE UNITED STATES FISH COMMISSION.

BY TARLETON H. BEAN, M. D.

The work of the United States Fish Commission has been very forcibly brought to my attention by a member of this society, who is now assistant in charge of the Divison of Fishculture in that organization. Having been at the head of that division for several years, and being naturally very much interested in the growth of the Commission, I was much struck by his presentation of this year's operations, now nearly finished. It is the climax of twenty-four years' continuous activity of the National Fish Commission, and represents, chiefly in the form of eggs, almost a billion in numbers. The totals of distribution of fish by the numerous stations not having been fully reported up to the present time, we will present the principal items in the form of eggs of fish and lobster.

EGGS OBTAINED BY THE U. S. FISH COMMISSION.

Pike perch	450,000,000
White fish	150,000,000
Cod	120,000,000
Shad	115,000,000
Lobster	70,000,000
Lake trout	13,000,000

Quinnat salmon..............	4.500,000
Flat fish......................	4,000,000
Brook trout..................	1,500,000
Rainbow trout................	1,250,000
Steelhead trout...............	1,000,000
Atlantic salmon...............	200,000
Landlocked salmon............	180,000
Total..................	930,630,000

Besides the above output of eggs, the Commission has distributed 70,000 young rock bass and 30,000 black bass ranging from four inches in length to adult size. These eggs and fish were produced at about twenty active stations. The cost of production and distribution, including the maintenance of the stations, was about $200,000.

I do not cite this as the greatest work done by any Fish Commission, but merely as one of the great triumphs of fishcultural operations. There are present other members of the Fisheries Society who can point with pride to their hundreds of millions of fish deposited during the past year by State Commissions.

The United States Commission was not the first in the field. The States of Massachusetts and Connecticut had commissions six or seven years before the national organization was in existence, and the American Fisheries Society, under its old name of the American Fishculturists' Association, was largely instrumental in establishing the National Commission.

The system of public fishculture, which originated in New England, has grown and increased in popularity and usefulness until there is no longer any need of supporting it except in the matter of appropriations.

The United States Fish Commission is a great fish and egg producing organization, but it can do nothing to enforce the protection of fish. From the nature of our laws, the United States cannot protect fish except in national waters. Fishery regulations are in the hands of the States and the State Fish Commissions combine with their fishcultural operations the equally important duty of fish protection. I believe the time is coming when the States will accomplish their object and regulate their fisheries in such a manner as to give proper protection to the fish.

What do we see in many centers of active fishery? There are laws, it is true, which are sometimes properly enforced, but in other localities there is no provision for enforcing them. This is particularly true of Alaska. The only thing which saves the salmon of Alaska, the most valuable fish in the Territory, is a law of commerce—the law of supply and demand. There are fish enough to last for years to come; there are perhaps as many as there were fifteen years ago, when I first studied the fisheries. Independently of the laws regulating the capture of salmon, for the enforcement of which there is no adequate provision, the law of supply and demand offers temporary protection for the fish. The canners must sell their wares. If they could sell all they can get they would take them without hesitation. Some of them have dammed the rivers, contrary to law, so that the fish cannot get up to their spawning grounds; but inability to market an over supply is now the only efficient safeguard of the salmon.

To return to the United States Fish Commission. The annual cost of the propagation and distribution of fish and maintenance of stations is about $200,000. The work in constantly growing; the demand for fish is increasing, but the appropriations for the past two years have been at a standstill. The Commissioners of the States, when their work is enlarged, urge their claims for increased appropriations and do not ask in vain; but the National Congress pays little heed to the wants of its Fish Commission. We have fallen upon a period of unwise retrenchment which has hurt the cause of public fish culture.

If the results so far obtained in the waters of the States and of the Nation are satisfactory in the light of statistics so well established, let the American Fisheries Society and the friends of fish culture in general unite in urging that the organization which has made such a splendid record be provided with the funds necessary to continue its achievements.

DISCUSSION ON THE PAPER OF

TARLETON H. BEAN, M. D.

Dr. James took up the discussion as follows:

"In my paper I set forth the idea of supply and demand. The fish should not be caught during the spawning season. Some movement should be started to keep them from being molested during their breeding time. If a sentiment could be created in the public mind, so that people would grasp this idea and there be no call for fish at this time, and no enquiries of the dealers for fish until after the breeding season, it would not necessitate going into other States and obtaining fish out of season. There should be a higher law inherent in the public mind to govern this question, and if this were the case, there would be no necessity for legislation on the subject, and the fish would thus be protected. There would then be no demand, and the matter would regulate itself, as well as the matter of interstate infringement upon fixed rights."

Mr. Peabody followed with the words:

"This paper of Dr. Bean's especially interests me as it refers to this matter of protection, which seems to be the paramount question, not the one of propagating fish but of protecting them after they are grown, which is the next question, and I have come 1,200 miles to get information and enlightenment on that subject, and I would like to hear the matter discussed thoroughly, and ask a few questions What has been the experience of the gentlemen present in the different States? What methods have been the most successful in creating public sentiment for the protection of fish, and along that line, game? One gentleman made a remark that struck me forcibly about making friends of the fishermen."

"I would like to ask whether it has ever occurred to the people whether we do not make too many laws and have them too stringent, and whether we do not make laws in the interest of the sportsmen and do not look to the interests of the people who live upon the streams and lakes. We should endeavor to have legislation for the people in general. Our laws are not quite enough in the interests of the people, farmers and persons living along the streams for instance."

"Our law regarding black bass and pike makes a close season from April 1st to June 1st, preventing the catching of black bass during April and May. It is the net fisherman who is the pirate, and who breaks the law. I am beginning to think that we have too close a season. Is it not possible to allow the catching of fish with hook and line, and would it not be just as well to have an open season if caught in this way, all the year? It would be well in our State, but whether it would work well in your section, I do not know."

"I would like to ask whether there have been good results from propagating black bass, and financially has there been any success. We have not had any success in our State."

Mr. Hoxie, of Carolina, R. I., said:

"This discussion has been to the advantage of the Fish Commissioners of the different States, but I am one of the unfortunate kind who is out of the State of New York and raise fish for the market. There is one little point I wish to bring before the Society, when they make an open season in New York. They have just passed a law which cuts us off from shipping trout there up to the 16th of April. Is there not some way to fix this thing? Is there not some way in which the man who makes a business of raising trout, for what little money there is in it, can be allowed to ship them into New York to the market whenever they are fit for it? The law seems a little unjust. If I were in Rhode Island and raised chickens and turkeys, I could send them at any time, but cannot send trout to New York, it being the market for what I produce. One year New York passed a law that we should not get fish until the first day of May. I am not doing a large business, but that year we did not pay our expenses by about $1,500. We have shipped already this season to New York over six tons of brook trout. The price has been low, but we cannot govern that if we don't get fish until the 16th day of April; but I would rather have February, March and April, I can sell then all I can raise, but later in the season people have gone out of town for the summer."

"I simply offer these suggestions to see whether something cannot be talked up, some just law made, so that we can have the privilege of selling our trout when they are fit for the market."

By the Chairman:

"One word on this matter. I take it that a close season for fish is for their protection during the season of reproduction, and that is the only interpretation to be given to it. It may work hardship for those engaged in raising and selling fish, if the law precludes them from following their occupation. It is to the interest of the whole people that the close season should be established for the protection of fish during the season of reproduction, and the interest of the individual should be subservient to the larger interest."

"Touching the questions presented here, if you make a close season, say from the first day of September to the first day of May, for the purpose of giving the fish time to reproduce, and if you permit market men to handle during that season fish taken outside of the State of New York, the market will be open for buyers, and it would work hardship to people engaged in raising trout for market."

Mr. Dale said:

"One word in regard to Mr. Peabody's enquiry about protection of the fish. The experience in our State, referred to by Mr. Ford, is well illustrated by examples of the Delaware and Susquehanna Rivers, where in ten years the value of the shad had risen steadily in the Delaware, while in the Susquehanna they have been depreciating all the time. The Delaware river has the protection of your laws. Our salmon, and also the shad, run up into your State, and if you should make a law that would keep this fish from getting up or down it would interfere with the general interest. They must go up where they will spawn, for they will not spawn down in the wider portion of the river, and thus one State depends upon another, and the laws of the different States should harmonize. The laws have been harmonized to some extent this winter. The New Jersey Legislature passed certain laws and I am glad to say these laws have been adopted, and the Governor has to enforce them, and I hope he will not veto this, as it covers joint interests, and the different interests ought to work together, and the laws of one State ought to agree with those of the other States.

In Pennsylvania the laws cannot protect the Susquehanna River, because the laws of Maryland interfere with it. The people have the weirs set the whole season, and catch a large amount of fish. There is a dam across the Susquehanna, and the law requires that they shall make ladders for the fish to go up and spawn, and men will take a long string, and attach a shining substance to the end of it, so that it will dangle over the ladder, and the bright surface will keep the fish from going up, for they keep away from bright surfaces, and thus they prevent the object of the law. Every man wants local interests protected by laws graded so as to cover the entire State, and we have to fight off a number of laws prejudicial to other laws, and you will all find the same thing to contend against."

"In the large cities and near by you can bring the law to bear, but in the outlying districts you cannot do this, unless you can bring the people to understand that they are thereby protecting their best interests. They prefer to get people up there to board who catch the fish, and they make more money in this way. We can enforce the laws if we can convince them that by protecting the fish and allowing them to increase they can make more money thereby."

A NEW HATCHERY.

BY HERSCHEL WHITAKER.

In America where the different governments, state and national, are continually branching out into new work, the mere fact of the construction and equipment of a new hatchery would scarcely create comment among fish culturists, and were it not for some reason, other than the mere statement of the fact, that Michigan is about to open a new and complete hatching station, I should not challenge your attention to the fact. There are, however, conditions in the environment of the locality of this new station, which make it somewhat unique, and I trust a brief statement of the opening of the new hatching station for the propagation of food and game fish at Sault Ste. Marie, Michigan, will be of sufficient interest to at least challenge something more than passing notice.

At what may be practically called the foot of Lake Superior, the waters of the lake plunge over a dyke of sandstone, creating a rapid of nearly a mile in length, with a fall of about 18 feet. The river at this point is nearly a mile in width, and the sandstone dyke forms the lip of an immense natural beaker of the purest water in the world, over which pours the surplus water collected in that great lake basin.

The temperature of the lake at twenty or thirty feet beneath its surface, is about 36 degrees during the hottest months of summer, and it abounds with brook trout, which are caught off the rocks and reefs, and with white fish, salmon trout and other fine varieties of fish.

There has always been located at the Sault Rapids, since its earliest discovery, an important white fish fishery during the entire year. At the first advent of the white man there were found congregated about the rapids a tribe of Indians known as the Sauteurs, who held undisputed possession of the territory surrounding the rapids, and prosecuted fishing during the greater part of the year. At the brink of the rapids, just above where the water breaks for its fall, there are taken, in season, brook trout weighing two, three and four pounds, sturdy and vigorous fighters, beautiful in tint and form. In the lower end of the rapids the Indian style of fishing, which I do not know to be practiced anywhere else, is yet carried on by the descendants of the aboriginal inhabitants in precisely the form in which it was conducted at the time of the discovery of the country, and it may be observed on any day during the spring, fall and summer months.

This method of fishing may not be without interest to those who have never seen it and I will describe it briefly for your information. The outfit consists of two Indians with a canoe (formerly of birch bark, now of wood) two setting poles, and a net strung on a hoop perhaps thirty inches to three feet in diameter, with a handle about ten to twelve feet in length. This is all the equipment they require for the sport or work, to be characterized according to the point of view from which the operation is observed. The canoe is propelled into the river near the foot of the rapids by an Indian in each end of the canoe, and it is swiftly and strongly driven into the rapids. The net lies across the thwarts within convenient reach of the Indian in the bow, ready for instant use. He watches intently for his quarry while the canoe is being pushed steadily forward through the boiling rapids, in which the uneducated eye of the white man would never detect a fish ; of a sudden there is a shrill cry from the bow Indian, he throws his pole into the bottom of the canoe, grasp his net, plunges it into the current and with a rapid movement it is driven to the bottom, is moved downward with the current, and is as quickly lifted out with one or more struggling and delicious white fish. This operation is repeated time after time until the fishermen have what they desire. As has before been stated, this method of fishing is now prosecuted in the same manner as when first seen by the early explorers, without change or variation.

The remnant of the tribe now living at the Rapids still follow this mode of fishing, and their livelihood is chiefly gained from this source, supplemented with the money derived from tourists who "shoot the Rapids" under Indian guidance. Many of the vessels navigating Lake Superior are furnished with fresh white fish taken in this manner by the Indians. While the fishery is confined to this method of fishing alone, it still remains fairly good, although the fish are of course less abundant than in former years. Fine brook trout can be taken at all points in Lake Superior with which I am familar, and many of the rocky reefs in the Sault river afford most excellent fishing for brook trout of good size.

The Sault river forms the boundary between the United States and Canada, and was formerly one of the most picturesque localities in the country. Both shores of the river, and especially the Canadian side, were dotted with beautiful wooded islands, and between them ran swift and sparkling channels, in which the finest of brook trout fishing was to be found. But the march of so-called civilization has within five years worked a great change, Two magnificent ship canals have been constructed on either side of the rapids by the different governments, and the islands have been largely obliterated in the construction of these "improvements." There are yet five islands lying in the rapids on the American shore at varying distances, approximately, from the mainland of from twenty to one hundred yards.

The superior natural advantages here afforded for the establishment of a combined white fish, brook trout and salmon trout hatchery, supplied with water which is the natural habitat of the brook trout, white fish and salmon trout, challenged the attention of the Board a number of years ago, but other necessary work demanded our attention, and no steps were taken to begin operations there until four years ago. At that time we established an experimental station in a rented building at the Sault, to settle, as far as possible, certain conditions about which there was an uncertainty. The experience of three years operations has fully demonstrated that the situation is desirable in every point of view, and during the last autumn a new hatchery was constructed, which at the beginning of the next hatching season will be in full operation.

The hatchery is located on one of the islands above referred to, near to the mainland on the American side, being separated from it by a narrow channel, and consists of a building 40x82 feet in size. One-half of the ground floor of the building will be fitted up for the hatching of white fish; the other half will be used for the hatching of brook and salmon trout. The trout portion of the work will be operated with a gravity supply of water, having a head of about seven feet. The white fish part of the house will be furnished with water by a pump run by electric currrent. The house will have a capacity of an annual output of approximately forty millions of white fish, three million brook trout, and five million salmon trout. The building is two stories in height, and the upper floor has been finished off with living rooms for employees, a shop, and a large room for storage purposes, etc. The interior of the house will be equipped with fire pipes, hose, etc., and the Electric Light & Power Company, located in the immediate neighborhood, will be connected with the hatchery by an electric alarm, and in case of fire the whole hatchery can be flooded almost instantly, thus affording ample fire protection.

A railroad spur is now being constructed to a point abreast of the hatchery on the mainland, and will be separated from the hatchery by the narrow channel above referred to. The cans of fry will be carried from the hatchery to the car by a carrier running upon a trolley wire, having a capacity of about a dozen cans.

When completed there will be thirty ponds constructed immediately below the islands on which the house stands, in which will be carried the stock fish of brook trout needed in connection with the work of the station. The main current of the rapids now flowing over the place upon which the ponds are to be constructed, with a depth of from two to four feet, will be diverted and controlled by a dyke or embankment, and inside of this dyke will be constructed the ponds for holding the parent fish. A canal inside this dyke will be made, from which will be taken the supply necessary for the ponds. The water of the rapids is unequalled for the purpose required, being thoroughly aerated in the boiling and seething rapids will be ideal in its character for carrying fish in ponds, and the supply is limitless.

The island itself and grounds connected with it, together with the ponds, will be embraced in and become a part of the United States Canal Reserve on which are the locks around the rapids. During the coming summer and succeeding one, the hatchery grounds will be fashioned into a beautiful park in conformity with the general parking scheme of the United States Engineer's Department, and when all is completed the hatchery and ponds will not be the least attractive feature of the park.

THE ARTIFICIAL HATCHING OF WHITE-FISH AND BROOK TROUT, AND THE RELATIONS OF PLANTING TO RESULTS.

BY SEYMOUR BOWER, SUPT. MICHIGAN FISH COMMISSION.

Perhaps the history of fish cultural operations on a scale of any magnitude affords no sharper contrast in appreciable results than is shown in the planting of brook trout in the streams of Michigan, and the planting of white fish in the Great Lakes. We cannot of course trace results as closely in one case as the other, because it is impossible to determine what proportion of the yield of white fish is due to artificial propagation, and what proportion originates from the native stock, while it *is* positively known that practically all of the brook trout in lower peninsula streams are primarily the result of planting,

But we are confronted with the fact, that from comparatively small annual plantings, over a thousand non-indigenuous streams are to-day so well populated with brook trout that the State of Michigan ranks second to none in the value of her trout streams, while in the face of annual plantings that run into the hundreds of millions, the yield of white fish has steadily declined. In one case, a supply that is constantly increasing has been introduced and built up from zero; in the other, a large native stock has been greatly reduced. It is true that the returns show that at a few points the shrinkage in the catch of whitefish has been checked, but the aggregate for the entire lakes has fallen far below that of ten or fifteen years ago.

On the other hand, we find that catches of one hundred brook trout per day, per man, are now too common in scores of our streams to attract attention. On the first day of May, 1894, over 5,000 trout of legal size were taken from a single ten mile stream in the southern part of the State, a stream that a few years ago was hardly considered capable of supporting brook trout at all. Abundant results are also reported from all quarters of the State, and the returns already realized compensate the cost of production and distribution many fold, amply justifying the work on grounds of public policy. These results are quite the reverse of what was at first anticipated, as the white fish are returned to indigenous waters, while the trout have been placed in waters in which the species had never existed.

The fact that the planting of white fish has failed to prevent a growing scarcity of mature fish, and a decay in the fishing, is necessarily involved and interwoven with economic abuses incident to the extent and methods of fishing; and while it is not my purpose to discuss the needs of restrictive measures, some reference to this phase of the subject is necessarily in order, otherwise those unacquainted with the facts might in all fairness conclude that the planting of white fish has been wholly barren of results.

Reliable statistics show that over 70 per cent. by *weight* of the white fish marketed from Michigan waters of the great Lakes are not sexually mature. The percentage by count is of course much greater; so that for years, independent of the enormous loss in their ultimate commercial value, a large proportion of the current stock has contributed absolutely nothing towards keeping up the supply. Reproduction is still further minimized through the removal of large numbers of adults on their way to the spawning grounds. The location of every white fish spawning shoal of any consequence throughout the lakes is well understood, and the migration of schools of parent fish towards these well known focal points, and their concentration thereon, affords a favorable opportunity for capture by the wholesale, and the interception of this annual pilgrimage towards a common Mecca for a common purpose constitutes by far the most profitable season of plunder for the Bedouins of economic warfare. Substantially the same condition of affairs exists throughout the American waters of the lakes. There are other abuses that tend towards a speedy extermination, but sufficient is shown to develop the important fact that for years natural reproduction has been restricted to the narrowest limits and is gradually approaching the vanishing point. We are therefore forced to the conclusion that much of the yield of white fish for the past few years and much of what remains is due to artificial propagation.

But notwithstanding all this, notwithstanding that the evidences of substantial and profitable returns clearly warrant a continuance of the work, we must acknowledge that vast numbers of the planted fish are still unaccounted for. The discrepancy between the number of fish planted and the number caught is too great for belief that the possibilities have been realized or even approached. We find that during the past 10 or 12 years, upwards of twenty-five white fish have been deposited for every one caught; that less than five per cent. of the fish turned out equals the whole number taken; so that if ten per cent. of the planted fish had survived to the average size taken, either the catch might have been doubled or the supply would have held its own through the agency of artificial propagation alone, without any assistance whatever from the natural hatch. In view of the relative numbers of young brook trout and white fish turned out and the striking contrast in visible results, we may fairly conclude that a large percentage of the trout have survived, while there is little room for doubt that 95 per cent. of the white fish have perished.

Up to the hatching point, so-called, artificial propagation saves the enormous waste that occurs in a state of nature and thereby multiplies results a hundred or a thousand fold; this is possible only because the conditions that are taken advantage of, and all the essential features that contribute to this result, are under our immediate observation and control. When ninety healthy fish are produced from every hundred eggs taken, as is now the case with white fish, there is little leeway for improvement in this direction. But progressive fish culture demands something more, and progressive fish culturists should not rest on their laurels, nor relax their efforts, simply because a supply of germs in prodigal numbers, and a knowledge of how to fertilize and bring them forward to the hatching point, has so cheapened the cost of producing fry by the millions that the narrow margin of survivors to the age of commercial value, more than compensates the outlay. The important question for progressive fish culture to answer is, how shall the percentage of survivors be increased? May not these millions of fry be so placed or disposed, that the loss by starvation and predatory fishers will be greatly diminished? Who can compute the enormous material wealth that would be created if the ratio of survivors might be increased from five to fifty, or to twenty-five, or even ten?

The solution of this problem of how to increase results, would also simplify some other complications, for with a fair ratio of increase in the number of survivors, their capture as fast as they matured, whether on spawning grounds or off, could not be regarded as economic abuse, *so long as artificial production was continued.* It would be no violation of economic law to annually harvest the matured crop in its entirety, and wholly without regard to natural reproduction, like any other cultivated crop, provided there might be a fair return from the abundant sowing made possible through the saving economy of artificial treatment of the seed. When these returns shall be able to force the production of mature white fish to its maximum without aid from the natural hatch, the only closed season indicated would be that during which the adults are associated with the young and immature fish, or in other words, before, not after, the natural sorting and grouping and massing of the parent fish had begun for the purpose of reproduction ; for, unlike the pike perch and many other spring spawners, white fish separate entirely from their own young during the spawning season. This conclusion must not be considered as applying to such kinds of fish as may not be propagated artifically and which guard their spawning beds, an important function, during the continuance of which they should not be molested.

The presumption is strong that a better knowledge of the "subsequent proceedings," a more thorough understanding of what constitutes appropriate environment, would enable us to plant more intelligently and thereby greatly increase the abundance of the harvest. A knowledge of early food conditions, its presence and abundance, as determined by previous examinations, would indicate where to plant and in what numbers the young fish should be set free in any given locality, and thus enable us to avoid planting in the wrong place, and over-planting in the right place.

If a definite number of artificially hatched fry might be transferred to strictly natural environment at the moment of hatching, no doubt the results would equal the results from a like number of fry hatched in nature. It therefore follows that if the ratio of fish matured from the former is less than from the latter, it is because we have failed to equalize conditions at the start. There are strong grounds for belief that this ratio *is* less, and that the unequal start in the race for life is responsible for the difference.

The white fish, unlike the small mouth black bass, which protects its bed from the depredations of spawn eating fish, fans away the sediment that might smother the embryos, separates the fungussed lumps by an occasional quick "flirt" of the tail, and thus produces a group of 2,000 to 6,000 young fish from a deposit of 10,000 to 15,000 eggs, casts its spawn and immediately departs, leaving such of the germs as may have been fertilized exposed for a period of five or six months to manifold agencies of destruction ; to the mud puppies and spawn eating fishes that assemble and lurk for the rich feast that awaits them ; to the deadly blight of fungus, and to be washed away from the reefs to settle and smother in mud and sediment. The percentage of fry produced under such circumstances must be very small ; in fact, one of those poor germs must feel something like the man who, after listening to an exhortation wherein it was shown that over 400.000 persons go to the bad place for everyone that succeeds in getting to Heaven, retired with the remark : Brothers and Sisters, you are all welcome to *my* chance." And yet, from this source alone, the lakes were once teeming with white fish, at a time, too, when predatory fishes, to prey on the young, were present in much greater abundance than in recent years, If started on terms of equality the planted fry of to-day are less handicapped than the natural hatch of their ancestors, and should produce a greater instead of a less percentage of results.

The tremenduous advantage of art over nature in the propagation of white fish is unquestioned up to a certain point ; but there is a point where this superiority suddenly ceases. Where is this point ? When has this dividing line been reached ? At what stage do thc resources of art suddenly lose their cunning ? Is it well along towards the time of hatching, when the embryos require no further manipulation or treatment ? Or is it at the moment of hatching, or five, ten, twenty or thirty days after hatching ? Little heed seems to have been paid to this important point, replete with significance though it may be, for until the past two seasons, the disposition of the fry has almost universally been governed by tank capacities and transportation facilities and a desire to make the widest possible distribution. As a result, considerable proportions of the hatch have been massed by the millions in the narrow and inadequate quarters of hatchery tanks, held back as long as a feeble spark of life remained, unmindful of the fact that to be on an equal footing with nature's fry, they should be liberated almost at the moment of hatching.

White fish fry, as such, are never stronger and more vigorous than at the moment of hatching. We find it imperative in practice that they must be moved at once if we would avoid losses in the house and on the road. When denied access to natural food conditions, as perforce they must be in hatcheries, and massed in large numbers, they grow visibly weaker within five days, and in ten to fifteen days many die, while the survivors are so weak and attenuated that there is little hope for their recovery under any conditions; the vital spark is too nearly extinguished to be relighted. It is therefore reasonable to suppose that millions on millions of fry have been turneα out only to perish, as a result of being held too long, thus denying access to appropriate food at the most tender and critical period of their existence. I wish to say most emphatically that these statements are not made in a spirit of criticism nor with an assumption of superior knowledge; they are made solely with a view to pointing out and profiting by what seems to be one of the reasons for the disappointing results that have attended the white fish work.

There is much in support of the general proposition that *all* fish require food almost as soon as they are able to swim freely. The white fish, unlike the brook trout, is a free swimmer the instant it succeeds in breaking the walls and escaping from its embryonic prison. Its so-called food sac is small and nearly absorbed, and though the further absorption of the yolk-sac is undoubtedly capable of keeping the fish alive for a time, the elements thus supplied cannot properly be regarded as food, while there is much to indicate that it fails to contribute *all* of the elements that are essential to a *normal* development. We know by actual observation that when confined in aquaria and freely supplied with plankton, they at least attempt the capture of minute animal forms, within one to three days after hatching, and sometimes with success. May not these real or apparent efforts to take food be regarded as springing from a sensation of hunger?

We find that the young of black bass begin to take food within forty hours after they rise from the spawning bed. We also find that within a few days after hatching, pikeperch fry become so hungry for somthing not supplied by the sac that they seize upon one another before the sac has wholly disappeared, and in a short time thereafter all the fish in a tank are destroyed in this way. We find, furthermore, that brook trout and all other large sac salmonids demand food as soon as they swim up, and that a lavish display of food at this particular time, dispensed at frequent intervals and in unstinted measure, is an important factor in the rearing percentage. We may substitute the natural food, but cannot successfully deny some form of sustenance other than that supplied by the sac. Most of the trout distributed by the Michigan Fish Commission have been put out before they could swim freely, and the others have been fed ; but in either case, natural food or a substitute was available when demanded. May not this pregnant fact have had an important bearing on the generous results that have followed ? The conclusion therefore seems a sound one that the time when the young of all kinds of fish require external contributions towards a normal development, dates from near the swimming point. If not. then there is little value in analogy and inductive reasoning as applied to known facts.

In this connection, brief mention may be made of recent experiments, on an unpretentious scale, at the Detroit station of the Michigan Fish Commission. During the recent hatching season, successive hatchings of white fish fry, in small numbers, were placed in the Detroit river, confined in small enclosures of wire cloth. The contents of some of these boxes have been lost through being pulled up and overturned or emptied by passing boats or boatmen, and others have been used up by preservation at stated intervals of a definite number for examination and identification of the stomach contents, which is in the hands of a competent scientist. So that at the present time, June 8th, only three boxes remain that have not been disturbed, except for the purpose of inspection. The fish in these three boxes have suffered but little natural loss, have grown quite rapidly and are now from one to one and a half inches in length. They were hatched April 20th and placed in the boxes the same day.

Three lots of fry of different hatchings were placed in small aquaria at the hatching station and have been fed exclusively on plankton from the river, daily towings being made for the purpose. These have grown faster than those in the river. Five or six specimens are fully two inches in length, and twenty or more have already developed the adipose dorsal.

Under a microscope the stomach contents of the aquarium fry show some microscopic forms, but for the most part comprise only such forms as are clearly visible to the unaided eye. In the aquaria, these forms dart about with great activity, a flea-like movement that often enables them to elude their pursuers, though singled out and followed and struck at repeatedly by the same fish. Their vigilance and ability to suddenly vamose, and the difficulty with which their capture is effected by strong and vigorous fry, suggests the thought that if the regimen of the millions of half-starved and emaciated fry that have been turned out, was restricted to *this* particular class of forms, their failure to report later on is readily accounted for.

The results of these experiments, meagre though they may be, have a special value in that they strongly indicate that a reasonably exact knowledge of all the essential conditions to be considered in planting, are within our reach. We are enabled to catch a glimpse of what it seems possible to accomplish through a systematic and scientific investigation of the waters, with special reference to the white fish problem, and along the line of inquiry suggested by these experiments. Several years ago an investigation of this nature was begun and ably conductud by Prof. Forbes, for the U. S. Fish Commission; but for some inscrutable reason it was dropped. There is urgent demand for its resumption all along the line, by every Commission engaged in the propagation of white fish. A source of great material wealth is on the toboggan; and if we fail to employ every available means of checking its rapid descent, we fail in our duty as agents and trustees of a vast public estate, with its still vaster possibilities. We should be keenly alive to the fact that the mere production of fry, though in vast numbers represented by 8 and 9 figures, or even 8 *times* 9 figures, in and of itself has no concrete value. We should arouse to the fact that the value of fish culture as a public enterprise, or considered from an economic standpoint. is not measured by the number of fish hatched, but by the number matured; and this paper will have accomplished all that was intended if it emphasizes the fact that hatching without intelligent discrimination in planting, is a ship at sea without a rudder, an arch without a key-stone.

GAME AND FISH PROTECTION.

BY FRANK J. AMSDEN, PRESIDENT OF THE NEW YORK STATE ASSOCIATION FOR THE PROTECTION OF FISH AND GAME.

At this moment the game laws and their enforcement are better than ever before. This is due to a very large extent to the activity of the friends of the law and through their organization.

We ask, and we think that we are not unreasonable, that all animals, birds and fish, should be undisturbed in their breeding season, and that they should be allowed to mature; and that nets and unlawful devices should be prohibited, except that nets may be used for food fish, under license and regulations by the State Fish Commission.

Prior to 1890 the game laws of this State were a mass of patchwork, confusion beyond measure, susceptible of almost any construction, and feebly enforced. About this time Gen. R. U. Sherman, Robert Roosevelt and Edward J. Whittaker, a committee appointed by the Legislature, after a very thorough investigation, submitted a bill of codified laws. It was passed, but not until it was sadly mutilated for selfish ends, or in the interests of the murderous element; but notwithstanding all this, so superior was its superstructure that it is to-day and will remain a standard not only for this State, but for all other States, and a monument to its builders. It repealed all the old and antiquated laws and made a basis upon which much good has since been built up.

But, gentlemen, no matter how good your laws may be, if not respected and enforced they are useless. A public sentiment in their favor is absolutely necessary. How to secure this is the problem. In this State we have, we think, found a solution in organization. In 1890, after the work of the Commission just mentioned had been accomplished, and encouraged by a set of laws that were clear and comprehensible, and by articles that appeared in the *Forest and Stream* signed "D. H. B." (Gen. Dwight H. Bruce, of Syracuse), several hundred enthusiastic lovers of the rod and gun assembled in Syracuse and proceeded to reorganize on a protective basis the old State sportsmen's association, which had declined into an annual trap-shooting tournament, changing the name to New York State Association for the Protection of Forests, Fish and Game. Its subsequent meetings have been largely attended and deep interest has been shown for better protective laws and their enforcement. Local clubs or branches have been encouraged and formed throughout the State. We feel our increased strength and realize a rapid changing of public sentiment—particularly so whenever a local club is formed. Our influence is now felt at Albany as it was never felt before. We find that the Fish Commissioners appreciate us and look to us and our work as a great auxiliary to theirs. The protectors also regard us as their friends and supporters. It encourages them to be more active and enables them to secure more convictions than formerly. I firmly believe that this is the true and best method to pursue. The friends of fish and game must organize and combine, if we would save the birds and fish It should be done all over the Union. It should be done locally and then in combination for strength. The local club can change public sentiment and control their representative, and the general organization can then frame the laws as desired and carry them through the Legislature. "In union there is strength." This has has been our experience. Results have exceeded our expectations. We are very greatly encouraged.

The past winter at Albany has been an active one. The Senate Committee, who were instructed by the previous Legislature to prepare a new game bill, have shown a very deep interest in the subject, far more than any previous committee. They held a number of hearings in different parts of the State during the summer of 1894, at which representatives of this Association appeared and were received in a very courteous manner. The bill which they presented was in many ways a decided improvement on the existing law. Many ambiguities and contradictions were removed. The law was simplified and made clear. Seasons were not materially altered, except to make them uniform, which was one of the main principles adopted at the beginning. In carrying this out it was necessary to change the open season on wild fowl, ducks, etc., so as to conform to the season on Long Island. This is unfortunate, for our Association as a whole desires to see spring shooting abolished everywhere, believing it all wrong; and that, if persisted in, it means the total extinction of the species. But Long Island interests will not yield, therefore shooters throughout the State became restive and demanded the same privilege; and they are right. It was justice; and so the law was made uniform throughout the State, making the open season to May 1st. Our Canadian friends complain bitterly, and well they may, for their close season on ducks begins January 1st. Much criticism is made on the strictness of Canadian laws for both birds and fish. But I believe that unless the people on this side of the border do follow their example, the wisdom of the Canadians will be very apparent, for they will have all the game, and if we want any shooting and fishing we Americans will have to pay them for it.

I must not forget to mention the fact, and it certainly is very gratifying, that our State Association law committee was shown such confidence by the Senate Committee that they were asked to assist in drawing up the bill that finally passed the Senate in most complete and satisfactory form, more nearly perfect than they expected to get it in a long time. This was a great compliment, and our Association appreciates it, for it shows conclusively what we have gained by organization.

I almost forgot to mention a new feature of the game law, which is a provision to license, under proper regulations prescribed by the Commissioners, the use of nets in some of our inland waters. After our experience with Lake Ontario, a body of water which has been exhausted by unrestricted netting, many of our associates looked with disfavor on this innovation, fearing that the privileges granted would be abused. As the provision was adopted on my suggestion, I sincerely hope that the plan will not prove unwise. Very much will depend on the care taken in preparing and enforcing the regulations.

In many of our inland waters there are vast quantities of desirable food fish, white fish, frost fish, bullheads, etc. These are not game fish and some of them cannot be taken by hook and line, If netted they will afford an excellent food fish for the people of the localities where found, and I believe that this concession will remove much of the friction now existing between these people and the friends of game and fish protection. Possibly, too, the netting will prove of advantage to the game fish by removing to some extent the competition for food and the destruction of their spawn.

As I have said, the bill left the Senate and went to the Assembly in a form which we thought was about perfect. I wish that I might stop here and say no more. But as a citizen of New York, the pioneer State of fish culture and game protection, I must confess my shame at the amendments incorporated into the measure in the Assembly. Slight changes were made in the general features of the bill, and this we consider fortunate, for we had grave apprehensions. But in some very surreptitious manner and at an hour when it was impossible to correct it without endangering the entire bill, a section was incorporated, No. 249, the effect of which is to foster and encourage crime, to put New York in the position of a fence, a receiver of stolen goods. This section will be a disgrace to our State as long as it shall be tolerated on the statute books. It permits the sale of game the entire year around. It says to the marketshooter, "Go to our sister States, shoot their game in season and out of season, invoice it and ship it to the old Empire State and we will help you to dispose of your unlawfully gotten plunder." And further, it says to those of the same disposition as to our own State, and there are many of them, "if you can get game out of season without being caught by the protectors, box it up tight and mark it eggs or dried apples, or by some other deceptive name; we will take care of it, and when it has been mixed up with Pennsylvania or Michigan game the difference cannot be told, for the invoice of your fellow market-hunter of Pennsylvania or Michigan will cover it all."

Such a blot on our statue books must be wiped out at the earliest moment. I shall not be content until it has been.

The thought occurs to me that our sister States must regard us with fine scorn and indignation for thus offering a premium to their own law-breakers for the paltry gain to be won. It would be only reciprocity for these States to offer the same premium to our own pot-hunters.

But such backward steps must not discourage us. Keep up the ranks and march in line. The victory is surely with us. The fish, the birds and the game animals in their wild condition belong to the people, and the public is now beginning to recognize this fact and to demand the preservation of its interests; and our law-makers are beginning to hear the demand, and they must give heed to it.

DISCUSSION ON THE PAPER OF MR. FRANK J. AMSDEN,

Mr. Edward P. Doyle, of Staten Island, in defense of the recent game laws, spoke as follows:

"Mr. President and Gentlemen of the American Fisheries Society:—The gentleman who has just read a paper has spoken of the crowning iniquity of the game laws, and inasmuch as he has spoken so very strong and has been so severe in speaking of it as a blot upon the statutes of the State, I think it well that I should tell what this law is that he construes as so deadly and dangerous."

"The Game, Fish and Poultry Dealers' Association of this city, whose members Mr. Amsden characterizes as "pirates" and men in a disreputable business, so to speak, is an Association composed of prominent men of this city, men like Offman and Robbins, of Fulton Market, and who have formed an Association to get what were their rights and what they were entitled to. They claim that large quantities of game was killed west of Chicago and shipped to every city of the U. S. except the city of New York, but that this great city of over 1,500,000 people was the only city, except in N. Y. State, where game could not be sold that was legally killed in other states. They sent a Delegation to Albany, or rather they first went to their Attorney and he drew a bill, which was introduced by an Assemblyman named Wilkes, and it was reported unanimously by the Committee, and finally ordered to a third reading, and would have been passed by the representatives of the people of the State of New York, and that bill was called to the attention of our people. Its adoption would have given too much latitude to the introduction of foreign game. The Chairman of the Game Laws Committee who is just as much a protectionist as any member here, called in Senator Guy, one of the active members of the Senate, who is familiar with game laws, to modify the Wilkes bill so that ample protection would be afforded to game in the State of New York. Senator Guy modified the bill, so that game coming in must be killed 300 miles from the State of New York. This would take in Chicago, and providing that the burden of proof was on the dealer that the game in his possession had been legally killed, and killed 300 miles from the State of New York, whether North, West or South, the transportation companies must mark such game, giving the place it came from, and mark invoices and way bills, and enter same in books at office. This information should also be entered in the books of dealers, and they shall permit the fish commissioners to examine their books at all times for the purpose of tracing game. The game to be brought in is killed, the larger part of it, west of Chicago. We have no right to presume that laws are openly violated in the Western States nor to say the people out there are poachers. We should presume that the laws are enforced and believe that this game was legally killed, and the good sober sense of the members of this society will accept this view. This society ought not to go on record as having said that reputable dealers and reputable transportation companies are openly violating the laws and swearing to false statements. Of course, as far as I am concerned, I belong to that unfortunate class who are not able to have game on the table and have no personal interest in the matter.

"I do not wish the statement to go on record that this is a blot upon the records of this State, and it ought to be wiped out. If it was proposed to send me to the Senate I would fight very hard to prevent this 'blot' being wiped out."

Question by Mr. Amsden :

"Do I understand you to say that the Legislature passed an act requiring that packages be properly marked game, the place they came from, and their destination?"

Answer: "The provision was made by Senator Guy that game should be marked game when brought in."

By Mr. Amsden :

"Mr. President, I do not want to get this meeting into a discussion on this matter. I think it will be well to let it rest. Before next winter I am perfectly satisfied in my mind that this bill will be repealed.

"Mr. President, you know what cold storage houses mean. You have seen the result in the Great Lakes, and this is one of the causes of the depletion of the lakes. How it will affect the game in New York State is uncertain. I actually know of one hunter living just west of Monroe County who last year acknowledged having shot 400 head of game birds and shipped them to New York. Our inspector was on the watch all the season and knew it, but we never got track of it. The law prohibits the shipment of game from one county to another. People can live without game, but I have boys, and want to see the coming generation have a little sport."

By Mr. May:

"This being an American Fisheries Society, it has little to do with game, and I believe that the sentiments expressed represent the two different sides of the question, and with your consent we will allow this matter to be passed over, and we will proceed with the further reading of papers, and as it is not within the provisions of this Society to consider the question of game, we will let it drop."

FISH FUNGUS AT CALEDONIA.

BY PROF. CHARLES WRIGHT DODGE.

DEPARTMENT OF BIOLOGY,
UNIVERSITY OF ROCHESTER,
ROCHESTER, N. Y., *June 11th, 1895.*

FRANK J. AMSDEN, Esq.,
Rochester.

MY DEAR SIR :—

The object of the experiments on the growth of the fungus (Saprolegnia) infesting the trout at Caledonia is to find a means of preventing, or at least retarding, the development of the fungus without at the same time killing the fish. It seems very evident that the whole body of water in Spring Creek contains the spores, as well as the growing plants, of the fungus. A single mature plant will produce many thousand spores under suitable conditions. Each spore is capable of producing another plant which in two days or less reaches maturity and, consequently, produces its quota of spores. Each spore is provided with a pair of delicate thread-shaped motile organs, by means of which it swims about in the water, like an "animalcule," until it finds a favorable place to grow. It then attaches itself to the substratum, which may be the dead and decaying, or frequently the living, body of a fish, snail, frog, insect, or some plant in the water. The motile organs are withdrawn into the substance of the spore, and small root-like outgrowths appear at the attached end of the spore and hold the latter in place as well as absorb the nourishment from the substratum. These spores, then, are not only able to swim about in stagnant water (to say nothing of being disseminated by flowing water) and to select a suitable place for development, but having found such a place, they are maintained in position by the firm attachment of their roots which are capable of penetrating not only the slimy skin of a fish, but even the hard shell-like coating of an insect. It is these spores mainly with which we have to contend. For, although the fungus forms another sort of spore, the latter is produced in much smaller numbers and does not immediately develop into a plant. The spores described above (known technically as "zoospores," from their animal-like habit of swimming about) are the sort which, from their number, rapidity of growth and motility, enable the plant to develop in enormous numbers and to become widely disseminated during a single season.

The fact that these zoospores are not covered by any sort of protecting skin or membrane gave rise to a hope that they might be destroyed to a greater or less extent by the addition of a disinfecting or germicidal substance to the water containing them. The choice of disinfectant was naturally limited to substances which would not injure the fish. It seemed, on the whole, best to try the effect of "electrozone," an exceedingly powerful germicide formed by the passage of an electric current through salt water. Electrozone can be swallowed without danger and seemed likely to be the best disinfectant to add to the water.

The first step in the experiment was to determine what proportion of electrozone the water must contain in order to stop the development of the fungus. To this end a series of test tubes plugged with cotton were thoroughly sterilized by baking. Then into each test tube was poured a certain amount of distilled water. To the water in each tube was then added variable amounts of electrozone. For example, the first tube contained 10 cubic centimeters (about 250 drops) of water and 1 drop of electrozone; the second tube, 25 cubic centimeters (625 drops) of water and 1 drop of electrozone, the third, 30 cubic centimeters (750 drops) of water and 1 drop of electrozone; the next two each contained 50 cubic centimeters (1,250 drops) of water with 1 drop of electrozone; and the last two each 100 cubic centimeters (2,500 drops) of water and 1 drop of electrozone. Into each test tube was then dropped a large fly (upon whose body the fungus rapidly grows). Each fly had previously been thoroughly rubbed upon the fungus-covered body of one of the trout brought from the creek the day before. The test tubes were then left for twenty-four hours, at the end of which time the fungus growth could be seen upon the bodies of all of the flies except those in the tubes containing 10 cubic centimeters of water with 1 drop of electrozone and 25 cubic centimeters of water with 1 drop of electrozone. At the end of forty-eight hours the fungus had developed in the second of these tubes. The outcome of these experiments is, then, that to prevent the growth of the fungus the ratio of electrozone to water must be 1 drop of the former to 250 drops (10 cubic centimeters) of the latter. It is to be regretted that other tubes containing 1 drop of electrozone to 15 cubic centimeters (375 drops) of water and 1 drop of electrozone to 20 cubic centimeters (500 drops) of water were not prepared, for it seems quite probable that further tests will show that a smaller amount than one part of electrozone to 250 parts of water will suffice. However, without waiting to learn the outcome of such experiments it seems best, the case being so urgent, to proceed at once to the hatchery and try the effect of electrozone on the fish. It may interfere seriously with their breathing, but nothing besides a trial will determine. In case they can endure the addition of the disinfectant, the next step will be to devise a practical method for the regular and gradual addition of the disinfectant to the running water. If this method of treatment be adopted it will have to be carried on until the fungus spores have nearly all been carried out of the creek. It is not expected of course entirely to rid the creek water of the fungus. At most it will be possible only to kill off the superabundance of spores.

Very truly yours,

CHARLES WRIGHT DODGE.

DISCUSSION ON THE PAPER OF MR. CHARLES WRIGHT DODGE.

Mr. Amsden spoke of the matter that had come up recently as to an epidemic among the trout in Spring Creek, which furnishes the water for the State ponds. It is a mile long and furnishes the water for the Hatcheries at Caledonia. This is a remarkable stream, as it has a temperature all the year round of 45 to 50 degrees, and abounds with lake trout, and of late years the German trout have been put in from the Hatcheries, and everything has gone along for years without any trouble except about eight years ago. At the head of this stream is a pond of about ten acres, which furnishes the power for a grist and saw mill. When the water gets low it has been the habit for years to store the water during the night, and the next day the bottom of the pond in some places is exposed. About eight years ago the owners of the mill took a notion they would kill the weeds in the bottom of the stream, and the result was that it brought down a mass of decayed vegetation, which killed in the neighborhood of 1,000 trout. Since then we have had no trouble until last week, when a few fish were found dead, and the next day the number of dead fish had increased, and the man who discovered them went to the head of the stream and found it entirely depopulated and the fish all gone, and it has since been ascertained that the fish went down the creek where they could get water that did not pass through this pond, but the other fish were dying rapidly. Upon examining the dead fish a fungus growth was discovered, which was also found upon all the others.

Mr. Bowman spoke as follows :—

"I have had some experience in Caledonia brook, and I never found one instance where there was an epidemic. It is a stream of remarkably pure water, and I dislike very much to have it advertised that there is any epidemic, and I think it occurs from the fact of the mill located at the head of the stream and the drying out of the water when the weather was hot, then being filled up very slowly with the water at 80 degrees. This killed the fish and caused the fungus to grow. It is difficult to say what causes fungus, and I do not think there is any fungus in Caledonia creek that a proper dose of salting will not cure. If a fish in fresh water has fungus you take it and put it into salt water, and vice versa, it will cure the fungus If several barrels of salt water had been poured into the creek it would likewise have caused the growth to disappear. If you find fungus, dump plenty of salt in ; it is the cheapest remedy you can find and the best.

"There ought to be no epidemic in Caledonia creek. I was there fishing not more than a mile from the head. I found no evidence of any sick fish, nor any evidence of fungus, and the fish rose to a fly, but a sick fish won't rise to a fly, and I caught them. I believe it came from the cause I spoke of. It is an important fact for all men who have anything to do with trout to understand the fact of salting fish, and giving them plenty of it, and this is based on my experience and that of my friends, and some of them have had twenty-five years' experience with this remedy of salt."

Mr. Ford then said: "In the hatchery at Allentown, whenever fungus appears on the fish, salt has been tried on them. We cure the fish by transferring them to tanks filled with salt water. Some gold fish were taken out of an aquarium filled with fresh water that had shown signs of fungus and put into an aquarium filled with salt water. This remedy was a success, and it is one that is available."

Mr. Mather said:

"I would say in reference to Mr. Bowman's remarks about salt for curing the fungus that it holds good if the fungus has not gone too far. If the fungus has grown through the outer skin and fastened its roots under the skin, I do not believe there is anything that will save that fish."

Dr. James:—

"The principle of any disease—for instance, consumption, in its early stages, is the same. If you apply the remedy before it has become rooted in the system it will cure the disease, but after a certain stage of the malady, complications arise, and thus it is with the fish. After the disease has penetrated into the lower structures of course the fish will die, but nevertheless salt is a good remedy."

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Trybom, Dr. Filip, Stockholm, Sweden.

Walpole, Hon. Spencer, Governor of the Isle of Man.

Wattel, M. Raveret, Secretary of the Société d' Acclimatation, Paris, France.

Young, Archibald, Esq., Inspector of Salmon Fisheries, Edinburgh, Scotland.

Active Members.

Adams, Dr. S. C., Peoria, Ills.
Adams, E. W., 114 Wall St., New York City.
Adirondack Reserve Association, (James Yealden, Treas.) 11 Pine St., New York City.
Agnew, John T., 284 Front St., New York City.
Alexander, * L. D., Stock Exchange, New York City.
Amsden, Frank J., Rochester, N. Y.
Anderson, J. F., 240 11th St., New York City.
Anderson, A. A., Bloomsburg, N. J.
Annin, Jr., James, Caledonia, N. Y.
Armstrong, C. E., Toledo, Ohio.
Atkins, Chas. G., East Orland, Me.
Ayer, F. W., Bangor, Me.
Babcock, C. H., Rochester, N. Y.
Balkam, Wm. F., Rochester, N. Y.
Banks, Charles, 453 Fifth Avenue, New York City.
Banks, R. Lenox, Albany, N. Y.
Barnum, Wm., Rochester, N. Y.
Bartlett, Dr. S. P., Quincy, Ills.
Bean, Dr. Tarleton H., Battery Park Aquarium, New York City.
Belmont, Perry, 19 Nassau St., New York City.
Benkard, James, New York City.
Bickmore, Prof. A. S., American Mus. Nat. Hist., NewYork City.
Bishop, Dr. Heber, 380 Newberry St., Boston, Mass.
Bissell, J. H., Detroit, Mich.
Blackford, Eugene G., 80 Fulton Market, New York City.
Blair, J. H., Omaha, Neb.
Booth, A., Cor. Lake and State Sts., Chicago, Ills.
Bottemanne, C. J., Bergen op Zoom, Holland.
Bower, Seymour, 234 Joseph Chapman Ave., Detroit, Mich.
Bowman, W. H., Rochester, N. Y.
Bradley, Dr. E., 19 30th St., New York City.
Brown, F. W., Cor. Broad and Cherry Sts., Philadelphia, Pa.
Brown, John E., U. S. Fish Commission, Washington, D. C.
Brown, S. C., U. S. National Museum, Washington, D. C.

* Resigns after 1895.

Bryan, Ed. C., Washington, D. C.
Bryson, Col. M. A., New York City.
Bull, H. S., 73 State St., Albany, N. Y.
Buller, N. R., Carolina, R. I.
Bush, Dr. E. F., Mount Vernon, N. Y.
Butler, Frank A., 291 Broadway, New York City.
Butler, W. H., 291 Broadway, New York City.
Carpenter Brook Fishing Club, Syracuse, N. Y.
Cary, Dr. H. H., Lagrange, Ga.
Chamberlayne, C. F., Buzzards Bay, Mass.
Cheney, A. N., Glens Falls, N. Y.
Clapham, Thos., Roslyn, Long Island.
Clapp, A. T., Sunbury, Pa.
Clark, A. Howard, U. S. National Museum, Washington, D C.
Clark, Frank N., Northville, Mich.
Clark, W. Campbell, Newark, N. J.
Collins, J. Penrose, 850 Drexel Building, Philadelphia, Pa.
Collins, Jos. W., Laurel, Md
Comstock, Oscar, Fulton Market, New York City.
Conklin, W. A., 5 Catherine St., New York City.
Corwin, D. P., 413 Wood St., Pittsburg, Pa.
Crook, Abel, 99 Nassau St., New York City
Crosby, Henry F., P. O. Box 3714, New York City.
Cox, W. V., U. S. National Museum, Washington, D. C.
Dale, Dr. Jas. A., York, Pa.
Davis, B. H., Palmyra, N. Y.
Davis, H. W., Grand Rapids, Mich.
Dean, Dr. Bashford, Columbia College, New York City.
Dean, H. D., U. S. Fish Commission, Cape Vincent, N. Y.
Demuth, H. C., 114 East King St., Lancaster, Pa.
Dewey, J. N., Toledo, O.
Donaldson, Thomas, Philadelphia, Pa.
Douredoure, B. L., 103 Walnut St., Philadelphia, Pa.
Downs, H. D., Birmingham, Conn.
Doyle, Edward P., Port Richmond, Staten Island, N. Y.
Dunning, Hon. Philo., Madison, Wis.
Earll, R. E., U. S. National Museum, Washington, D. C.

Ebel, Hon. F. W., Harrisburg Pa.
Ellis, J. F., U. S. Fish Commission, Washington, D. C.
Fairbank, N. K., Chicago, Ills.
Fitzhugh, D. H., Bay City, Mich.
Foord, John., Civil Service Commission, New York City.
Ford, H. C., 1823 Vine St., Philadelphia, Pa.
Foulds, Dr. T. H., Glens Falls, N. Y.
French, Asa B., South Braintree, Mass.
Friesmuth, Jr., E. N., 151 North 3d St., Philadelphia, Pa.
Frothingham, H. P., Mount Arlington, N. J.
Garman, Samuel, Mus. Comp. Zool., Cambridge, Mass.
Gavitt, W. S., Lyons, N. Y.
Gay, John, 1020 Arch St., Philadelphia, Pa.
Gilbert, W. L , Plymouth, Mass.
Goode, G. Brown, U. S. National Museum, Washington, D. C.
Green, M. A., Rochester, N. Y.
Griffith, C. E., Port Richmond, Staten Island, N. Y.
Gunckel, J. E., Toledo, O,
Habershaw, Fred., New York City.
Hackney, D. G., Fort Plain, N. Y.
Hagert, Edwin, 32 6th St., Philadelphia, Pa.
Hale, A. G., Reeds Creek, N. Y.
Haley, Albert, Fulton Market, New York City.
Haley, Caleb, Fulton Market, New York City.
Hall, G. W.
Hamilton, Robert, Greenwich, N. Y.
Hansen, G., Osceola, Wis.
Harris, J. N., Fulton Market, New York City.
Harris, Gwynne, Washington, D. C.
Harris, W. C., American Angler, 19 Park Place, New York City.
Hartley, R. M., 627 Walnut St., Philadelphia, Pa.
Hasbrouck, C. T., Cleveland, O.
Hayes, A A.
Hazel, Edwin.
Henshall, Dr. J. A., Cincinnatti, O.
Hergesheimer, W. S., 2145 N. 22d St., Philadelphia, Pa.
Hessel, Rudolph, 1207 H St., N. W., Washington, D. C.

Hill, M. B., Clayton, N. Y.
Hill, W. J.
Hinchman, C. C., Detroit, Mich.
Hofer, J. C., Bellaire, O.
Hoxie, J. W., Carolina, R. I.
Hughes, T. W. B., 258 Broadway, New York City.
Humphreys, Dr. E. W., Salisbury Md.
Huntington, L. D., New Rochelle, N. Y.
Huntington, W. R., Cleveland, Ohio.
Hurlbut, H. F., 5 Lincoln St., Lynn, Mass.
Hutchinson, Chas., Utica, N. Y.
Hutchinson, E. S , Washington, D. C.
Hyneman, A. A., 55 W. 33d. St , New York City.
Imbrie, Chas. F., 18 Vesey St., New York City.
Isaacs, M., Stock Exchange, New York City,
James, Dr. B. W., N. E. Cor. 18th and Greene Sts., Philadelphia, Pa.
Jennings, G. E , 317 Broadway, New York City.
Jessup, F. J , 88 Cortland St., New York City.
Johnston. S. M , Battery Wharf, Boston, Mass.
Jones, Alexander, Woods Hole, Mass.
Jones, Dr. O. L., 116 W. 72d. St., New York City.
Jones, R. W., Syracuse, N. Y.
Kauffman, S. H.. *Evening Star*, Washington, D. C.
Keene, J. H., Greenwich, N. Y.
Kelly, P., 346 6th Ave., New York City.
Kimball, R. J. New York City.
Klock, G. S., Rome, N. Y.
Lawrence, F. C., Union Club, New York City.
Leavenworth, C. W., Wilkes-Barre, Pa.
Long, J. Verner, University Club, Pittsburg, Pa.
Loring, J. A., 3 Pemberton Square, Boston, Mass.
Lydecker, Major G. I., U. S. Engineers, Washington, D. C.
Lyman, H. H., Oswego, N. Y.
McDonald,*Marshall, U.S. Fish Commissioner, Washington, D.C.
McGown, H. P., 76 Nassau St., New York City.
Mackay, R. M., 1517 N. 14th St , Philadelphia, Pa.

* Died Sept. 1, 1895.

Mallory, Chas., Foot Burling Slip, New York City.
Manning, W. W., Marquette, Mich.
Mansfield, Lt. H. B., U. S. Navy Yard, Brooklyn, N. Y.
Marks, W. D., Caledonia, N. Y.
Mather, Fred., Cold Spring Harbor, N. Y.
May, W. L., Omaha, Neb.
Mayer, H. M.,
Meehan, W. E., Public Ledger, Philadelphia, Pa.
Merrill, F. J., Albany, N. Y.
Middleton, W., Fulton Market, New York City.
Milbank, S. W., Union Club, New York City.
Miles, J. F., 1820 Arch St., Philadelphia, Pa.
Miller, E., Fulton Market, New York City.
Miller, J. O., Mt. Kisco, N. Y.
Miller, S. B., Fulton Market, New York City.
Mills, G. T., Carson City, Nevada.
Mitchell, A., Norwich, Conn.
Mohican Rod and Gun Club, Glens Falls, N. Y.
Moon, G. T., Fulton Wholesale Fish Market, New York City.
Moore, G. H. H., Washington, D. C.
Morrell, Daniel, Hartford, Conn.
Nevins, James, Madison, Wis.
O'Brien, M. E., South Bend, Neb.
Offensend, J. H., Fair Haven, Vt.
O'Hage, Dr. Justus, St. Paul, Minn.
Orvis, Chas. F., Manchester, Vt.
Osborn, C. V., Dayton, O.
Page, George, 49 Wall St., New York City.
Page, Parker W., West Summit, N. J.
Page, Wm. F., Neosho, Mo.
Palmer, G. H.
Parker, Dr. Joel C., Grand Rapids, Mich.
Parker, Jr., Peter, South Framingham, Mass.
Peabody, G. F., Appleton, Wis.
Pease, Charles, East Rockport, O.
Pfieffer, Jr., Geo., Camden, N. J.
Porter, B. P., Colton, Cal.

Post, Hoyt, Detroit, Mich.
Powell, W. L., Harrisburg, Pa.
Powers, J. A., Lansingburg, N. Y.
Preston, Dr. H. G., 98 Lafayette Square, Brooklyn, N. Y.
Quackenbos,* J. D., 331 W. 28th St., New York City.
Rathbun, Richard, U. S. Fish Commission, Washington, D. C.
Ravenel, W. de C., U. S. Fish Commission, Washington, D. C.
Reinecke, T., New York City.
Reynal, J., New York City.
Reynolds, C. B., 318 Broadway, New York City.
Ricardo, Geo., Hackensack, N. J.
Robeson, G. M., Trenton, N. J.
Rogers,* H. M., Fulton Market, New York City.
Rowinville, E. T., East Freetown, Mass.
Rufmayer, L. M.
Saranac Lake Hotel Co., Ampersand, N. Y.
Schaffer, G. H., New York City.
Schuermann, C. W., Smithsonian Inst., Washington, D. C.
Schuyler, H. P.
Sherwin, H. A., 100 Canal St., Cleveland, O.
Simmons, Newton.
Smiley, C. W., 943 Mass. Ave., N. W., Washington, D. C.
Smith, Dr. H. M., U. S. Fish Commission, Washington, L. C.
Spangler, A. M., 529 Commerce St., Philadelphia, Pa.
Spensley, Calvert, Mineral Point, Wis.
Spofford, H.
Stelwagen, W., Philadelphia, Pa.
Stone, Livingston, Baird, Shasta Co., Cal.
Stone, S. R., 58 Pine St., New York City.
Stranahan, J. J., Put-in Bay, Ohio.
Streuber, L., Erie, Pa.
Sweeny, Dr. R. O., Duluth, Minn.
Taylor, Jr., Alexander, Mamaroneck, N. Y.
Thompson, E., Northport, Long Island, N. Y.
Titcomb, J. W., St. Johnsbury, Vt.
Tomlin, W. D., Duluth, Minn.

* Resigns after 1895.

Upton, G. W., Warren, O.
Van Brunt, C., South St., New York City.
Van Cleef, J. S., Poughkeepsie, N. Y.
Van Valkenberg, B. F., 288 Greenwich St., New York City.
Wallace, N., Farmington, Conn.
Walton, C. W., 1713 Spring Garden St., Philadelphia, Pa.
Webb, W. Seward, 44th St. and Vanderbilt Ave., New York City.
Weed, W. R., Potsdam, N. Y.
Weeks, Seth E., Bloomington, Ind.
Welshons, G. D., Pittsburg, Pa.
Whitaker, E. G., 29 Broadway, New York City.
Whitaker, Herschel, Detroit, Mich.
Wilbur, E. R., 318 Broadway, New York City.
Wilbur, H. O., 3d, below Pine St., Philadelphia, Pa.
Wilcox, Joseph, Media, Pa.
Wilcox, W. A., U. S. Fish Commission, Washington, D. C.
Willetts, J. C., 49 Wall St., New York City.
Williams, A. C., Chagrin Falls, O.
Wilmot, Samuel, Ottawa, Canada.
Wilson, J. Paul, Washington, D. C.
Witherbee, W. C., Port Henry, N. Y.
Wood, Benjamin, Park Place, New York City.
Woodruff, G. D., Sherman, Conn.
Worth, S. G., U. S. Fish Commission, Washington, D. C.
Zweighalt, S., 1323 Franklin St., Philadelphia, Pa.

TRANSACTIONS

OF THE

American Fisheries Society

TWENTY-FIFTH ANNUAL MEETING.

Held at Battery Park Aquarium, New York City,

Wednesday and Thursday, May 20th and 21st, 1896.

GLENS FALLS PRINTING CO.,
GLENS FALLS, N. Y.
1897.

OFFICERS FOR 1896-'97.

PRESIDENT, HERSCHEL WHITAKER .... *Detroit, Mich.*

VICE-PRES., DR. BUSHROD W. JAMES .... *Philadelphia, Penn.*

TREASURER, L. D. HUNTINGTON .... *New Rochelle, N. Y.*

REC. SEC'Y, A. NELSON CHENEY .... *Glens Falls, N. Y.*

COR. SEC'Y, H. B. MANSFIELD, U. S. N. .... *Navy Yard, Brooklyn.*

EXECUTIVE COMMITTEE.

H. C. FORD .... *Pennsylvania*

W. L. MAY .... *Nebraska*

J. W. TITCOMB .... *Vermont*

DR. T. H. BEAN .... *New York*

F. B. DICKERSON .... *Michigan*

J. E. GUNCKEL .... *Ohio*

TABLE OF CONTENTS.

MINUTES

OF THE

TWENTY-FIFTH ANNUAL MEETING

OF THE

AMERICAN FISHERIES SOCIETY,

HELD IN

BATTERY PARK AQUARIUM,

Castle Garden, N. Y.,

ON WEDNESDAY, MAY 20TH, 1896.

The following members were present on roll call:

J. E. Gunckel,	Toledo, Ohio.
Frank J. Amsden,	Rochester, N. Y.
Bernard L. Douredoure,	Philadelphia, Pa.
T. E. Crossman,	Brooklyn, N. Y.
Jas. A. Dale,	York, Pa.
Edward Thompson,	Northport, N. Y.
Louis Struber,	Erie, Pa.
G. E. Jennings,	New York City.
F. B. Dickerson,	Detroit, Mich.
Herschel Whitaker,	Detroit, Mich.
H. B. Mansfield,	U. S. Navy.
A. N. Cheney,	Glens Falls, N. Y.
Chas. H. Babcock,	Rochester, N. Y.
Barnet H. Davis,	Palmyra, N. Y.
Fred Mather,	Brooklyn, N. Y.

Jno. W. Titcomb,	St. Johnsbury, Vt.
Edward P. Doyle,	New York City.
Tarleton H. Bean,	New York City.
L. D. Huntington,	New Rochelle, N. Y.
D. G. Hackney,	Fort Plain, N. Y.
James Annin, Jr.,	Caledonia, N. Y.
Dr. Bushrod W. James,	Philadelphia, Pa.
H. P. Frothingham,	Mount Arlington, N. J.
Hendrick S. Holden,	Syracuse, N. Y.
L. D. Alexander,	New York City.

PRESIDENT'S ADDRESS.

GENTLEMEN:

I take this the first opportunity offered to thank you for the honor conferred at our last meeting in selecting me as your President, it having (with few exceptions) been the custom of previous Presidents to submit an address at the Annual Meeting of the Society upon some kindred subject. I feel reluctant to continue the custom, for the reason that it would consume much valuable time of our brief business session of a single day, which scarcely affords time to transact the necessary yearly business of the Society, the reading of the able and interesting papers prepared by many of the members, and a full discussion of the same. Therefore, I shall confine myself briefly to a strictly business matter, although one in my judgment that is of vital importance to all organizations, that is, "Membership and finance."

Gentlemen, when I carefully looked into this important matter as President of this organization I found by the Treasurer's report a balance of $64.06 in the treasury, and of which amount the Treasurer informed me $30 was from dues of 1895. There were still bills for the year 1894 amounting to $156.70 unpaid, making a deficiency of $92.64, which without the $30 dues of 1895 left an actual deficit of $122.64 for year 1894, and this with a published membership list of about 260 members. The Secretary and myself prepared and sent out three different circulars to various members and otherwise made every effort to to collect all dues, as well as to correct the list of members. The result has been that the deficiency of 1894, as well as all expenses of the Society for 1895, have been paid, and there should now be a balance of $120 and over in the treasury. In connection with this matter I have carefully prepared a detailed statement, which I submit for the information of members present. L. D. HUNTINGTON.

Mr. H. Whitaker: In order that we may have an orderly proceeding, I would suggest that there are probably gentlemen who desire to join the Society. I have the names of a couple. I think they ought to participate in the proceedings regularly; and I therefore suggest that the names of new members be now presented and referred to the Executive Committee to report at this session. I propose the names of Mr. Freeman B. Dickerson, one of the members of the Michigan Fish Commission, and Mr. Bryant Walker, of Detroit.

The President: Any gentlemen having new members to propose, they will please offer them now, as it is customary for the Secretary to cast the ballot and make one job of it; and if the gentlemen are here they can take part in the proceedings.

Mr. Dale: I solicited the Fish Commissioners of California to become members of the Society, and I have received a letter from them enclosing six dollars for the membership of two of the gentlemen, Messrs. H. T. Emerick and William C. Murdoch, of California.

Mr. Huntington proposed the name of Charles H. Walters, of Cold Spring Harbor, N. Y.

Mr. Babcock proposed the name of Hendrick S. Holden, of Syracuse, one of the Commissioners of Fisheries, Game, and Forests, of New York State.

The President: The Secretary requests me to ask the gentlemen in proposing names of new members to kindly submit them in writing with the address, that he may have the names with the addresses perfectly correct. He says it is impossible for him to hear them with the assurance of getting them correctly, and that is one of the great difficulties we found in trying to correct our list, that names have been misspelled and the residences are very often wrong.

The President: It has been suggested by Mr. Whitaker that he is the only member of the Executive Committee present, to whom these names would be referred to act upon, and that I should appoint other members temporarily. Therefore, in the absence of the other members of the Executive Committee, and for that purpose, I will name Mr. Cheney and Mr. Gunckel.

The Committee then retired.

The President: The Executive Committee, to whom were submitted the names of the candidates for membership, are prepared to make a report. We will hear the report of the Executive Committee on the names submitted to them.

REPORT OF COMMITTEE.

THE AMERICAN FISHERIES SOCIETY.

Gentlemen: The Executive Committee, to whom was referred the matter of applications for membership, beg leave to report that they recommend the election of the following persons to membership in the American Fisheries Society:

Hendrick S. Holden,	Syracuse, N. Y.
Charles H. Walters,	Cold Spring Harbor, N. Y.

H. T. Emerick,	San Francisco, Cal.
William C. Murdoch,	San Francisco, Cal.
Freeman B. Dickerson,	Detroit, Mich.
Bryant Walker,	Detroit, Mich.

Respectfully submitted,

HERSCHEL WHITAKER,
A. N. CHENEY,
J. E. GUNCKEL,
Committee.

Mr. Whitaker: I move that the report of the Committee be accepted and these gentlemen declared elected.

The President put the question, which was carried.

The President: Mr. Secretary, have you any report to make?

The Secretary then submitted the following report:

NEW YORK CITY, U. S. A.,
BATTERY PARK AQUARIUM, May 20, 1896.

AMERICAN FISHERIES SOCIETY.

Gentlemen: I have the honor to present a brief account of my duties as Recording Secretary of the Fisheries Society.

A resolution of the Committee on Nominations last year, adopted June 12, recommended a change in the style and character of the transactions and that the volume be published within sixty days after the meeting. Your Recording Secretary earnestly tried to carry out this praiseworthy resolution, but a delay of two months was caused by the fact that some of the articles had been given out for newspaper publication and could not be recovered sooner. Another greater delay occurred through the failure of many members to reply to letters and circulars asking for information about names and addresses to revise our membership list, which was known to be full of errors.

There was also a great deal of difficulty in revising the report of the discussions of papers—a difficulty which, I regret to say, was not satisfactorily removed. Finally, in November, the copy of transactions for 1895 went to the printer, who thought so much of it that he held it in suspense until the end of January, 1896. Some copies were mailed on the day of their receipt, January 31, and on February 4 the last of them were sent out.

Three circulars asking for payment of dues and data for correction of membership list were mailed in July, November, and February. The first notice of the meeting was issued March 15 and the final notice on April 25.

It is earnestly suggested that the Secretary alone cannot transact the business of the Society; he must have the full co-operation of all the members in order to perform his work efficiently and promptly. The membership list must be still further corrected, and it is due to the Secretary, who edits the transactions, to let him have all papers first and let the newspapers wait until copies can be furnished.

Very respectfully,

TARLETON H. BEAN.

The President: You have heard the report of the Secretary and if there is no objection it will be placed on file.

The President: The Treasurer's report is next in order.

The Treasurer presented the following report:

TREASURER'S REPORT.

FRANK J. AMSDEN,
IN ACCOUNT WITH
AMERICAN FISHERIES SOCIETY.

DR.

To balance on hand	$ 64.06	
Membership dues received to date	477.00	
		$541.06

CR.

Thos. Humphrey	$ 6.51	
Express	.40	
Stenography	20.00	
Express	.55	
Thos. Humphrey, balance on bill of 1894	156.70	
Lehman Bros.	6.50	
Thos. Humphrey	2.50	
Type-writing	1.75	
Thos. Humphrey	6.00	
Letter Book	3.75	
T. H. Bean	19.59	
Thos. Humphrey	162.00	
" "	2.00	
Mr. Huntington, postage	3.00	
Thos. Humphrey	3.00	
Postage	5.00	
Express	.50	
Cash on hand	141.32	
		$541.06

NEW YORK, May 20, 1896.

Approved, CHAS. H. BABCOCK,
BERNARD L. DOUREDOURE,
G. E. JENNINGS,
Auditing Committee.

The President: No objection being made, the report of the Treasurer will be accepted and placed on file.

The President: It has been customary, early in the session, to appoint a committee of three on auditing, committee of five on nominations, and a committee of three on next place of meeting. I find that to be customary, and if some gentleman will make a motion to that effect, I will announce the committees and they can report soon after we reconvene this afternoon.

Mr. Whitaker: I move that the President be authorized to appoint the necessary committees. *Carried.*

The President: There is one thing that has caused a great deal of trouble. There have been a number of members claimed that they resigned at a certain time. There are nine members who have paid their dues—there were ten—and with their dues have requested that their resignations be accepted. Following are the names of these nine members: Jno. T. Agnew, J. Penrose Collins, J. Brown Goode, Chas. F. Imbrie, J. D. Quackenbos, H. M. Rogers, Benjamin Wood, N. Wallace, A. Haley. These gentlemen have paid their dues up, and asked that their resignations be accepted. I think it is proper and right. We have no records of any resignations on our book; and this has been a great cause of difficulty in correcting this list. That is one reason why it is not correct. These gentlemen have paid their dues and ask that the Society accept their resignations.

Mr. Cheney: I move that the resignations of the nine members whose names have been read be accepted. *Carried.*

The President: I believe the routine business is completed.

The Secretary: Will you appoint the committees?

The President: I will appoint them in a few minutes.

Mr. Whitaker: Before the regular order of business of reading papers is begun, and in line with the suggestion contained in the report of the Secretary, I would like to offer the following resolution: *Resolved*, That all papers read before the Society be handed to the Secretary and retained by him for publication. I think it may overcome the difficulty referred to.

Mr. Cheney: Do you mean to say that the newspapers are not to have access to them?

Mr. Whitaker: We cannot go beyond our own business here. There is no reason why the writer of a paper, if he wishes to do so, should not furnish anybody he cares to with a copy of the paper. The original paper should be retained, so that we will have no further trouble of this kind, and no delay in the publication of our report by reason of it.

Mr. Whitaker's resolution was put and carried.

The President: We will now proceed to read the papers, and perhaps it would be well for the Secretary to read the titles of the papers that are to be read.

The Secretary: The list of papers, arranged in the order of the receipt of letters announcing them, is as follows:

J. E. Gunckel, Toledo, O. *Hon. Emery Davis Potter.*

Fred Mather, Brooklyn, N. Y. *Natural Food for Trout Fry.*

Dr. Tarleton H. Bean, Battery Park Aquarium, New York. *Pond Culture of California Salmon in France.*

A. Nelson Cheney, Glens Falls, N. Y. *Concerning the Work of the Fisheries, Game, and Forest Commission of the State of New York.*

H. P. Frothingham, Sec. and Treas. N. J. Fish and Game Commission, Mt. Arlington, N. J. *Report on the Protection of Fish and Game in the State of New Jersey.*

Dr. Bushrod W. James, N. E. cor. 18th and Green Sts., Phila., Pa. *Inter-State Protection of Food Fish.*

Seymour Brown, Detroit, Mich. *The Propagation of Small-mouthed Black Bass.*

L. D. Huntington, New Rochelle, N. Y. *Waste of Food Fish.*

The Secretary: I think Mr. Gunckel is the first on the list of those mentioned who is present.

Mr. H. Whitaker: Last year, or two years ago, to favor gentlemen who had prepared papers and had taken the pains to be present, we gave such papers the preference in the reading, and we ought to follow that practice each year. If the writer of a paper is present in person such papers should be first read. Let them be followed by the papers submitted by those who are absent; and I move that that order be adopted this year. *Carried.*

The President: We will now listen to the paper by Mr. Gunckel on the Hon. Emory Davis Potter. At the conclusion of the reading of the paper Mr. Gunckel distributed photographs of Judge Potter to the members.

The President: Dr. Bean has a paper on the "Cultivation of the California Salmon in France."

Dr. Bean: I am very much afraid that this paper is too long to be read just now. At the same time, it is a paper which bears upon the subject which we have been discussing, looked at from the French standpoint. It has to do with the rearing of the California Salmon in France, in ponds; and I would like to read it to the Society.

The President suggested that it be postponed until the afternoon session, which was agreed to.

The President: The Secretary will now announce the committees that have been appointed.

The Secretary read the committees as follows:

Committee to audit the Accounts and Treasurer's report:

Messrs. Babcock, Douredoure, and Jennings.

Committee on Nominations:

Messrs. Whitaker, Mansfield, Dale, Gunckel, and Mather.

Committee on Locality and Time of the Next Meeting:

Messrs. Davis, Struber, and Dickerson.

Committee on the resolution of Mr. Mather to draft a suitable statement upon the death of Judge Potter:

Messrs. Mather, Gunckel, and Whitaker.

Mr. Herschel Whitaker: If you will put somebody else on the Memorial Committee it will gratify me; I shall be engaged.

Mr. Mather: I would like very much if you will put some one else on the Nominating Committee in my place. It is not at all sure that I will be here tomorrow.

Mr. Whitaker: The Committee will report today.

Mr. Mather: I would rather not serve.

Mr. Titcomb was substituted in place of Mr. Mather on the Nominating Committee.

Mr. Amsden was substitued in place of Mr. Whitaker on the Memorial Committee relative to the death of Judge Potter.

Mr. Gunckel: Can these committees meet today?

The President: The ordinary committees are supposed to meet and report very soon after we reconvene.

Mr. Whitaker: I move that we adjourn until two o'clock.

The President: A motion has been made to take a recess until two o'clock. Gentlemen, before we adjourn, I would like to have you hear from the gentleman who is the Chairman of the Committee on Entertainment tomorrow; and it is quite likely that he will outline what you may expect from the committee.

Mr. Davis: Gentlemen, in behalf of the Fish Commissioners of the State of New York, I desire to state that the committee will give an excursion tomorrow to the Cold Spring Hatchery, leaving Pier A, just adjoining the Battery, at nine o'clock. We would like to have you all present with your friends.

The President: There is one further matter my attention has been called to. There is a register here, which it is desirable to have each and every member sign, so that we may get his name and address correctly.

The meeting then adjourned until 2 o'clock.

Wednesday Afternoon Session.

The President called the meeting to order at 2:10 o'clock.

Mr. E. Whitaker: Mr. President and gentlemen: Having had a somewhat extended experience in attempts to pass and defeat game laws, and having studied a great deal as to the solution of the difficulty, in order to overcome and obviate the necessity for the everlasting changes being made, so that a man may know from month to month and year to year what the game laws are—I say, after considering that, I have come to the conclusion that there is just one way in which the game laws can be put into such shape that there will be at least some certainty and some reasonableness in them; and that is, that the constitutions or statutes of the several states should contain a provision creating a game and fish commission, that should be constitutional officers, and they should be vested with the power to pass upon all game laws, so that their veto should kill any act that the Legislature might pass, in case the commission should deem it an impracticable act. I believe that is the only way in which we will ever get a uniform and certain and a constant game law throughout the states. It is better, even, to have a bad law, and have it well understood and certain, than to have a good law that is constantly shifting and changing.

With that end in view, I offer this resolution, in order to get the sense of this Association upon the subject, because this Association, representing, as it does, the different states, is the only Association whose opinions will go throughout the different states, and whose opinions will have force. It was with that intention that I drew this resolution:

Resolved, That it is the sense of this Society that each state should provide in its Constitution for a Fish and Game Commission, and should also provide that no law should be passed permitting, prohibiting, or regulating the catching of fish or game without the approval of such Fish and Game Commission.

The President: Gentlemen, you have heard the resolution offered by Mr. E. Whitaker. Is it seconded?

Mr. Thompson: I second the resolution.

Dr. B. W. James: I ask the gentleman whether he intends in this resolution that he offers that the Commission shall include both the fish and game laws?

Mr. Whitaker: I think so; yes, sir.

Dr. James: We have in our State Legislature in Pennsylvania a committee called the Fish and Game

Committee, and all these matters are referred to that Committee, which is jointly interested in these two matters. They came on one occasion into conflict over some game laws and fish laws, which did not work harmoniously, and it was found that probably the fish interest had better be alone, and the game laws alone, in the charge of separate committees. I am fully in favor of protecting some way both the game as well as the fish of this country. The matter has been up before us in our Society in Philadelphia, with the aim of getting together the different fish organizations of the state, in order that we might conciliate those in the western part of the state, the commission there being rather inimical to some of the laws we want passed for the larger rivers, like the Delaware and Susquehanna.

In the upper streams they want to clean the streams out in certain parts, which, in our state, have certain of these hatcheries supported by the state funds, and our Society wants to nourish and keep them together and add to them. There is an element in the state which desires to wipe out the commission altogether and to do away with these fish hatcheries. In the session before the last—our Legislature meets every two years—I found that spirit emphasized there, and I did not know but that before the Legislature adjourned we would have the fish commissioners abolished, not this year, but in the future. The idea was to cut down the appropriations and make them so small that they could not support the hatcheries. Then the plan was to cut down the salaries of the commissioners, and make it so useless that a man would not pay attention to the interest, and in that way the effort was made, but it did not succeed.

The question is whether this resolution covering both fish and game in the one commission would be advisable or not. I am in favor of it fully, and if it can be worked together, I would like to have the resolution passed as it is here. I have given my experience in my own state in regard to having the two commissions together.

Mr. Amsden: I am glad to have this matter brought up in the shape in which it is presented, and I think it would be advantageous for the Society to take a stand on the resolution. I have had some experience in New York State in the matter of legislation—getting good laws passed and bad ones defeated. Going back now to the time when Mr. Whitaker, Gen. Sherman, and Mr. Blackford, I think it was, were made a codifying committee on the game laws, and they presented a report which was approved. It went to the Legislature and was so mangled there that it could hardly be recognized; but, after all, the subsequent legislation that has been carried on at Albany has been brought gradually down to their original proposition or report.

The great trouble we experience at Albany is this, that in the two houses are men who have no knowledge on the question at all, and are apt to be led and influenced by their constituents more in favor of liberty than protection.

This resolution is quite a step in the right direction. I do not expect to see it accomplished immediately, but I would like to see the beginning made in this way in this Society, which is really the head and leader of all our work, and perhaps in time we may bring it about.

The laws enacted this winter in our Legislature fortunately have been guided and influenced very much by our commission, which had the matter of protection well established in their own minds, and when the matter was referred to them they acted in that direction with better results. It is unfortunate that the Legislature should perform their duties in this line in the way they do. There is one thing I do realize, and have all the while, and that is the lack of stability in our laws. The people themselves are ignorant all the time as to what the law is. Every year we have to re-inform them as to what the laws are; changing and shifting the laws each year makes confusion. If we could only have laws fixed and have them constant for a number of years, it would be a very great advantage. I am very much in favor of the resolution, and should have offered it myself if it had not been offered by Mr. Whitaker.

Mr. E. Whitaker: I would suggest that it would be well for the President to appoint a committee from each of the states, as far as he can, to carry the resolution into effect; and I ask to be excused from serving on that committee.

The President: The question is for the chair to appoint a committee of one from each state?

Mr. E. Whitaker: One or more.

The President: The chair will, when he has leisure, make that selection.

Mr. H. Whitaker: I hope the chair will not excuse Mr. E. Whitaker from serving on the committee. He is the most familiar with the subject; he is responsible for this thing, and he cannot dodge the responsibility.

Mr. Thompson: This matter is in the hands of the chair.

The President: The chair does not propose to be tampered with by the profession or any of the Whitaker family. (Laughter.)

The President: We will now receive the report of the Nominating Committee.

REPORT OF THE NOMINATING COMMITTEE.

American Fisheries Society.

Gentlemen: The Nominating Committee make the following report:

For President, Herschel Whitaker.
Vice-President, Bushrod W. James.
Recording Secretary, A. N. Cheney.
Corresponding Secretary, H. B. Mansfield.
Treasurer, L. D. Huntington.

Executive Committee—

H. C. Ford,
Freeman B. Dickerson,
W. L. May,
J. W. Titcomb,
J. E. Gunckel,
Tarleton H. Bean.

Respectfully submitted,

H. Whitaker,
H. B. Mansfield,
J. A. Dale,
J. E. Gunckel,
J. W. Titcomb,
Nominating Committee.

Mr. E. Whitaker moved that the report be adopted.

The President: If I understand it, the adoption of the report has always carried the election; that has been the rule.

The President: The Auditing Committee will now report.

REPORT OF THE AUDITING COMMITTEE.

American Fisheries Society.

Gentlemen: The committee appointed by the chair to examine the accounts of the Treasurer respectfully report that they have examined the books and vouchers of the Treasurer and find the same to be correct.

Respectfully submitted,

CHARLES H. BABCOCK,
B. L. DOUREDOURE,
G. E. JENNINGS,
Committee.

The President: If there is no objection the report of the committee will be considered as adopted.

Mr. Davis reported for the committee to select the next place for holding the annual meeting, that they had selected Detroit, Michigan.

Mr. Davis: Under the resolution the committee was not empowered to designate the time, only the place; but we recommend June 17 and 18, 1897.

The President: No objection being made, the report of the committee will be considered as adopted.

Mr. Mather: Mr. President, the committee appointed to draft the resolutions concerning Judge Potter concluded that the time was not sufficient in which to do it, and we ask for further time.

Mr. H. Whitaker moved that the committee be granted further time in which to report. *Carried.*

The President: The next paper in order under the resolution passed would be that of Dr. Tarleton H. Bean. Since we adjourned we have with us Dr. Bushrod W. James, who has a paper to read, "The Interstate Protection of Food Fish." As Dr. Bean's paper is somewhat in connection with the previous paper that was read, if there be no objection, I think it would be advisable to have Dr. Bean's paper read and then take up the paper of Dr. James afterwards. We will now have Dr. Bean's paper on "The Culture of California Salmon in France."

Dr. Bean: I must apologize for the length of this paper, but where it is possible I will omit such portions as may be practicable. It has been partly dictated to a stenographer and partly written in longhand, and I have had no time to revise it. I think you will overlook the length of the paper, and allow me to do the best I can to give you the essential points without taking up too much time. It is an interesting paper, and especially so to us, because it refers incidentally to the pond method of rearing trout by means of natural food, that is, food which is supplied in the pond itself; and it is interesting for another reason, which is, that a Frenchman of high repute, a man in the first rank of fish culture in Paris, has succeeded in raising profitably as a commercial venture the California Salmon in ponds in France; secondly, he has secured the reproduction of that species without its ever having gone to salt water, and he says that after five generations in fresh water, the spawning is as ample as it was at the beginning. He says, furthermore, that the mortality among the females after spawning is much less than we know it to be in the natural condition of affairs in the Western rivers. It seems to me these things are matters of much importance to us, and on that account I hope you will bear with me if I do speak at some length.

Dr. Jousset de Bellesme is a man of the highest rank as a fish culturist, the director of the Aquarium of the Trocadéro in Paris, where, in a small space, a good many problems in the rearing of the *salmonidæ*, especially introduced *salmonidæ*, have been successfully carried out. I want to say further that my impressions of the results obtained by Dr. Jousset de Bellesme are drawn from personal observation, for I had the pleasure of seeing what he accomplished in the Trocadéro Aquarium, and I am sure that nowhere else in the world is the California Salmon reared as successfully, grown as quickly, and in a general way brought into such condition as in that Aquarium.

Dr. Bean then reads paper.

Mr. Cheney then read a paper on "The Work of the Fisheries, Game, and Forest Commission of the State of New York."

The President: Gentlemen, if there is no discussion desired upon the paper, no remarks to be offered, we will proceed to the next paper, which is by Dr. B. W. James on "The Interstate Protection of Food Fish."

Dr. James: I think a very important point is the protection of the fish from an interstate point of view. We had some discussion on the subject some years ago, and I brought up the point that there had been cases where the Government has decided that it is unconstitutional to pass any United States law; and yet it seems that there ought to be some measure by which all the states could be reached. The practice of having the states make separate laws does not seem to work very well. I simply want to throw out some ideas to keep the matter up in the minds of the people interested; not that I want to give any information to those working in the direction of propagating fish, my idea being in the way of protecting the food fishes of the states and country at large. If my views do not coincide with those held by you, you are at liberty to discuss them as freely as you wish.

Dr. James then read his paper.

Dr. James: In the Delaware River some years ago the promiscuous fishing reduced the amount of shad, as I believe has been stated on this floor by Mr. Ford, to a valuation of about seventy-five thousand dollars. During the year before last I think it had reached a valuation of some four hundred thousand dollars, and last year, I have it from Mr. Ford, who is our commissioner, it amounted to over five hundred and twenty-five thousand dollars, and this year the supply of shad on the Delaware has been unprecedented. We have had a larger number of fish running in the Delaware, and of course the fisheries have represented a larger income than last year. We have been propagating these fishes in the hatcheries. There has been one recently established at Bristol, on the Delaware, and the commissioners are busy at Gloucester collecting the eggs in all the large fisheries. They propagate these, and they are put in the upper streams, so that in that way we are aiming to increase the amount of fish in our larger streams and getting a larger return for our state. What Pennsylvania reaps in that way, of course New Jersey and New York is likely to get some of the benefit of.

The Secretary: Mr. Huntington has a paper, somewhat in line with the paper just read.

The President: I have a paper here on "Waste of Food Fish." While we have heard the grievances of the lake region, etc., I wish to state the grievances of we sea-board people.

Mr. Dickerson: I would offer this resolution:

Resolved, That a committee consisting of the President-elect and the Secretary be appointed a committee to prepare a uniform bill for the protection of fish in all the states bordering on the Great Lakes; that the bill be submitted to the various commissions for approval, and that the bill be submitted to the next Legislature in each state.

Mr. Amsden: I think we ought also to include the rivers that cover the shad fishing, and also this matter of menhaden. It is time that this Society showed itself to be something and acted on something, and I think we have a President who can take hold, with the assistance of such a committee as he may appoint at his leisure, and accomplish something. The proposed bill should go on record, and with the communications presented will be argument enough, and ought to be presented in proper form as coming from the American Fisheries Society, so that after a while it will become known as an aggressive body.

Mr. Whitaker: I want to make a suggestion as to the resolution. I would ask Mr. Dickerson to re-form it. The bill should be drafted after conversation with these men representing the different states and an agreement from them. I suggest that Mr. Dickerson put his resolution in this form: "That it is the sense of this American Fisheries Society that some such action should be taken," and leave the matter of the drafting of a uniform bill to a subsequent meeting, that shall represent the interests of the different states.

Mr. Amsden: Will you have it, Mr. Whitaker, that it comes from this Society, so that the Society gets the credit of it?

Mr. Whitaker: The Society gets the credit for it, in adopting it as its sense.

The President: Do you accept the suggestion Mr. Dickerson?

Mr. Dickerson: Yes, sir.

Dr. James: With regard to this matter, it seems to me that it is time for action. All the debate on this subject here recently shows that there is a very great need for action upon this subject by the states, and if we leave it to the states indefinitely, the Government of the United States will take no action, and, of course, in that event we will not accomplish anything, and the sooner we get at the matter the better. The resolution as originally offered was most correctly framed, because the President and Secretary certainly have all these different laws at their command and know just what is needed, and if some sort of a draft is made and brought up at our next meeting and discussed, we will have something to act upon. If it is left indefinitely in this way, simply recommendatory, it may fall as other things have fallen. I am in favor of prompt action; and not only that, I would like to see the same action taken in the direction of looking forward to the international supervision in the same way of the coast interests and our entrance to the rivers, if it is possible. If it cannot be done under the Constitution of the United States, then Canada and Mexico and the United States ought by some method to appoint a joint commission or joint committee, which could devise some way by which their interests can all be brought together, and they can recommend in some form a sort of international agreement for the protection of the waters in the neighborhood of their individual countries. It must come to that sooner or later; otherwise the ocean will be depopulated of many of its food fish and of the larger fish.

We do know that up in the Northwestern country, where other countries come in, bordering on the waters of the Behring Sea, in years to come you will find that great international questions will arise out of this late decision as to the method which has been adopted in two countries, bringing together their countries and deciding by this method which has been adopted in settling that question. It is not settled, as other nations must come in. There must be an international law other than this three-mile method. There must be some law by which the fish coming from one country to another, or one part of the ocean to the other, coming in as a source of product and resource to Canada and Mexico, must be met by some international provision. A simple protection three miles from the coast does not meet the question. We all see that, and sooner or later it must come to that; and before that we should, if possible, get all the states in this country, so far as we have authority to suggest, this

American Fisheries Society ought to induce the states to get together and make their laws governing the states and the borders of these states in which food fish are. Subsequently, in years to come, there must naturally be an international law which will protect larger areas. The whale and other large fishes in Northern countries are nearly all gone and will continue to fall away, and so will the salmon fisheries, we all know, sooner or later be abandoned, because of their unproductiveness, on account of the way they are being taken into the market; and we ought to look forward to some ultimate action in that way.

Mr. Thompson: I wish to offer this resolution:

Resolved, That the President appoint a committee of one member from each of the seaboard states, to whom the subject of Mr. Huntington's paper shall be referred, with power.

Dr. Bean: I would like to make a remark on the resolution which is before the Society, if I may be allowed to do so. The resolution of Mr. Dickerson provides that a committee be appointed to draft a form of bill to be approved by the various commissions for the protection of fish in the various states bordering on the Great Lakes, and that such bill be submitted to the next Legislature in each state.

Mr. Chairman, the remark I want to make is this: We have been members of the Fisheries Society for a great many years, and we have observed the course of business here, I think, very thoroughly. Now, it appears to me that the work of the Society for a good many years, after we got away from New York, Chicago, Detroit, or Washington, or wherever the meeting may be held, falls upon the President and Secretary. Mr. Whitaker knows it; Mr. Huntington knows it; Mr. Amsden knows it; we all know it. Is it going to fall upon the President and Secretary again, or will the committees which may be appointed for special work do that work, conduct the correspondence, get the results, and make the reports?

A member (facetiously, perhaps): They have never been asked.

Dr. Bean: "They have never been asked?" There it is in the transactions, and how many men have acted on the instructions under which they were appointed last year? I do not say it in a fault-finding spirit, but it is true, and we all know it is true; and I hope it will not be so hereafter.

Mr. H. Whitaker: I would like to offer a substitute for both of these resolutions. I do not think the American Fisheries Society can do anything more than act as an advisory body. Any laws that may be drawn up, for general action by the lake states or seaboard states, must be agreed to by representatives of this Society. Your President or Secretary cannot do it. They can simply call a meeting, if it is your desire. I am aware of the very thing Dr. Bean refers to there, a resolution authorizing this thing to be done last year. If it is the sense of the Society that this thing should be done, the President will be glad to call together the members of the different commissions and of the fishermen of the lake states and seaboard states to meet in some convenient hotel, where these things can be done. The President and Secretary cannot draw up a form of a law and say you must agree to this. It would be arbitrary, and you can never make an agreement of that kind; but let the commission come together and discuss this thing; and if the Society re-affirms what it did last year, and says that it is the desire of the members that the President call a meeting next fall to discuss this question, it will be done.

No two men, Secretary, President, Treasurer, or anybody else, entirely out of this Society, should draft a bill which is to govern the action of states in which they had no part whatever. It is impracticable, and that is all there is to it. I would move this as a substitute, if the gentlemen who introduced the other resolutions—Messrs. Dickerson and Thompson—will permit it:

Resolved, That it is the sense of the American Fisheries Society that laws regulating the commercial fisheries of the seaboard and of the Great Lakes should be drawn in the interest of the people and for the protection of the fisheries.

If this resolution is adopted, I think the President should be authorized to call a meeting of the representatives interested.

Dr. James: It is not that they shall draw a law to be enforced, but to draw up the features of a law which will embody all the points connected with this matter, and submit it to the commissions, and then get their approval, and next year we will have the basis by which some general law can be suggested by the Society.

Mr. Whitaker: If we are going to do anything, we have got to do it this fall, because many of our Western states have biennial sessions of the Legislature, and the first of January the matter must be presented. It would be a work of supererogation, and something we had no business to do, to make a law of that kind. Let us go to some of the gentlemen interested and then make that draft, and ask each state to bring it before the Legislature and get it passed.

I, therefore, renew my motion that the sense of the American Fisheries Society is that the commercial fisheries should be protected by proper laws; and that the President be authorized to call a meeting of the representatives of the different states to consult on the matter of uniform legislation.

The President: Before the motion is put, I desire to say one word in connection with the resolution offered by Mr. Thompson. It appears, as regards the troubles on the Great Lakes, which run from 400 to 1400 miles distant from the seaboard, that you cannot very well provide for both of them at one time; neither do they both cover the exact ground, and are so far apart, and there is such a difference between the two points, both in distance and other things, that it would be well to separate them.

Mr. Whitaker: I think so, too.

The President: I would like to say this, gentlemen. I would like to see a committee appointed for the seaboard states, selected from members of this Society who are members of fish commissions, and let these people come together, and in justice to all interests see if they cannot get something which will be acceptable to the Legislatures of the respective seaboard states.

Mr. Amsden: There ought to be no delay.

The President: We will take the matter right up. Therefore, if you will relieve the resolution of Mr. Thompson from your motion, Mr. Whitaker—

Mr. H. Whitaker: I think it is better to withdraw the whole thing and then let the other resolutions be adopted.

The President: We will now consider the resolution of Mr. Thompson.

Dr. James: I have lost the thread of the business. I understood the resolution of Mr. Whitaker was first in order.

The President: That was withdrawn. The motion is now upon the adoption of the resolution of Mr. Thompson. It is as follows:

Resolved, That the President appoint a committee of one member from each of the seaboard states, to whom the subject of Mr. Huntington's paper shall be referred with power.

The question was put on the resolution, which was adopted.

Mr. Dickerson: I move that the President appoint a committee consisting of one member from each of the several Great Lake states, to whom the subject of protecting commercial fisheries shall be referred.

This resolution was carried.

The President: Mr. Whitaker has a paper.

Mr. Whitaker: I want to say to you that I have a paper here, which is of considerable interest, on the "Culture of Black Bass," but the hour is getting too late to read it. I understand there is to be a meeting tomorrow, and if it is to be held, and there is time for the consideration of this paper, I think we had better postpone the reading until tomorrow. May I ask what the arrangements are as to that matter?

The President: We will have a meeting on the boat if there is any business.

Mr. Whitaker: I suggest that the further reading of papers be deferred until tomorrow.

Dr. James: Perhaps while we are on this business we had better finish these papers.

Mr. Whitaker: Mr. Cheney said that he had an engagement and had to go away soon, and would like to have the reading deferred.

Dr. James: I think there would be more interest taken in the papers now than on the boat.

The President: There was a paper from Mr. Frothingham, who could not remain to read it, but who will be on the boat tomorrow. There are two papers.

Mr. Babcock moved that the thanks of the Society be and they are hereby tendered to Mr. L. D. Huntington, Mr. Frank J. Amsden, and Dr. Tarleton H. Bean, the retiring President, Treasurer, and Secretary, for the efficient services tendered the Society in the past year, by putting it on a better financial basis and increasing the public interest therein.

Mr. Babcock called upon the new President, Mr. Whitaker, to put the motion to the house.

Mr. Whitaker: Courtesy will not permit the sitting President to present this motion; and therefore, at the suggestion of our friend from New York, I will put the motion to the house.

Unanimously carried.

The President put the question to the house whether to go on with the reading of the papers or to postpone them until tomorrow.

The President: It is understood that the reading of the papers is postponed until tomorrow.

Mr. Dickerson: I move that the Secretary be requested to insert the picture of Judge Potter in the transactions of this meeting, with the memorial.

Carried.

Mr. Mather announced that his article on scallops, which was announced to appear in the July number of the Popular Science Monthly, would be deferred until the August number.

On motion, adjourned to meet on the steamer *Valley Girl* at nine o'clock on Thursday morning.

SECOND DAY, THURSDAY, MAY 21ST, 1896.

Meeting called to order by President Huntington on steamer *Valley Girl.*

In the absence of Dr. Bean, the Recording Secretary, A. N. Cheney, Recording Secretary-elect, acted as Secretary.

The paper written by Mr. Seymour Bower, Supt. Michigan Fish Commission, upon "The Propagation of the Small-mouthed Black Bass," was read by Commissioner Whitaker. Owing to the absence of the stenographer, who missed the boat, the discussion which followed this paper was not reported.

By Mr. Whitaker:

Resolved, That the thanks of the American Fisheries Society be and are hereby tendered to the Fisheries, Game, and Forest Commission of New York for the entertainment tendered to this Society, and also to its efficient committee, Messrs. Davis, Holden, and Thompson.

Carried.

By Mr. Davis:

Resolved, That the thanks of the American Fisheries Society be and are hereby tendered to Mr. Starin for his almost annual courtesy of the use of a steamer for the entertainment of the Society.

Carried.

By Mr. Cheney:

Resolved, That the thanks of the American Fisheries Society are due to the Board of Parks of New York City, for the use of the lecture room of the Aquarium at Battery Park, and that they be tendered through the President of the Board, Hon. S. V. R. Cruger.

Carried.

The paper of Commissioner Frothingham, upon "Fish and Game Protection in New Jersey," was, in his absence, read by Secretary Cheney.

The names of Hon. F. D. Kilburn and Hon. John L. Hill were proposed for membership in the Society by Commissioner Thompson. Referred to Executive Committee and elected.

By Mr. Titcomb:

Resolved, That the meeting in Detroit in 1897 shall continue for three days, viz., June 17th, 18th, and 19th.

Seconded by Mr. Whitaker and carried.

The Committee upon resolutions on the death of Judge Potter reported:

The passing of Judge Emory D. Potter, a long-time and useful member of this Society calls for more than casual notice. Judge Potter's active identification with public affairs marked him as an important figure in national legislation during his political activities, and his important services in that connection will be deeply appreciated and have been duly noticed, and need not be here further referred to.

But his deep interest in fish culture and his influence in the shaping of public opinion demanding the protection of the public's interest in the commercial fisheries, is a matter of which this Society hereby desires to make due acknowledgment. The active years of his life were spent in advocating these principles, and the influence he exerted along these lines will be long remembered by reason of the passage of good laws and the creation of a deep public interest in these questions. It is therefore

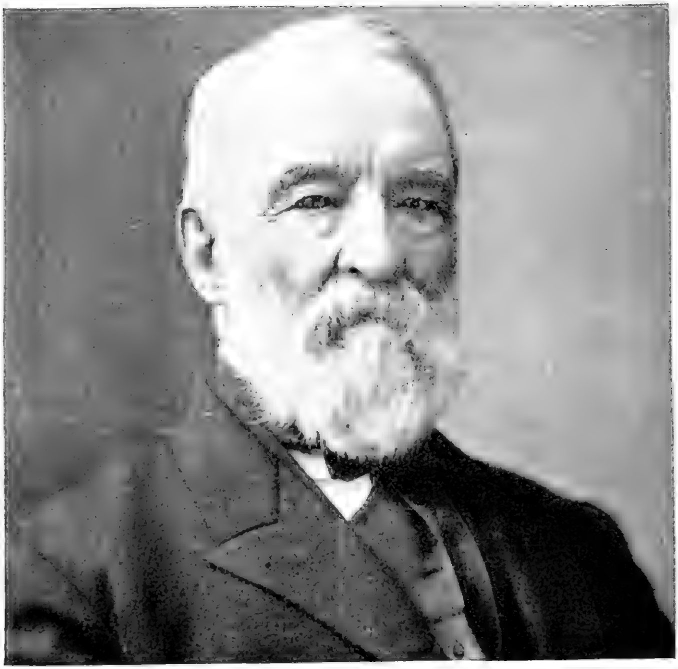
Resolved, That this Society shall order spread upon its minutes an expression of regret for his death; and that we recognize therein that fish culture has lost one of its pioneers and most earnest advocates.

That the sympathy of this Society be extended to his family in their bereavement, and that we mourn with them, not only the death of a good friend, but the loss to his state and community of an upright man and a good citizen.

J. E. Gunckel.

Upon motion adjourned.

A. N. Cheney,
Acting Secretary.



EMERY DAVIS POTTER.

HON. EMERY DAVIS POTTER.

BY J. E. GUNCKEL, FISH COMMISSIONER OF OHIO.

A biographical sketch is probably the least interesting of any subject that could possibly be presented to a society the aim and object of which is the consideration of the propagation and protection of fish, but if you will bear with me for a very few minutes I will present to your attention a subject that will excite your interest and command your appreciation. By request I am to speak to you of a man whose name has been familiarly known throughout the United States, and intimately known to many of us for nearly half a century. As a member of this Society, and as Fish Commissioner of Ohio for many years, no person took a greater personal interest in the propagation and distribution of fish. From the first experiments in 1853 of artificial breeding of trout, when he was intimately associated with the late Dr. Theodatus Garlick, to the time of his death in 1896, he was a faithful advocate of the objects of this Society. I would like to invite your attention to a brief memorial touching the life history of our esteemed companion, showing his relationship to the interests of this Association and what we learn from the lessons so patiently taught us for nearly a century.

Some of the most distinguished men of the country have paid the highest tribute to his memory. Men of national reputation have paid homage to his worth and expressed their admiration of his many virtues.

Emery Davis Potter was born in Providence, Rhode Island, the 7th day of October, 1804, and died February 12th, 1896, in the ninety-second year of his age. The family removed to Otsego County, New York, in 1806. Like most of the early pioneers of our country he devoted his leisure hours to studying such books as fell, by chance, into his possession, and during the winter he attended the public schools, receiving such instruction in the branches of learning as were taught in those days. After many years of hard, earnest labor he entered the office of John A. Dix, at Cooperstown, New York. Mr. Dix was subsequently Governor of New York; later United States Senator from that state, and Secretary of the Treasury. Completing his studies, Mr. Potter was admitted to practice in New York, but soon decided to make his home in the West. He arrived at Toledo, Ohio, in the winter of 1834. His qualities as a lawyer and his high standing among the people were appreciated, and in 1838 he was postmaster in Toledo. In 1839 he was elected by the Legislature as Presiding Judge of the Common Pleas Court of the Thirteenth Judicial District, covering all of Northwestern Ohio.

Many interesting experiences he delighted to repeat, in later years, relative to his traveling from county to county on horseback, through dense wilderness, and how in the absence of bridges he was compelled to swim streams and resort to methods wholly unknown to the present generation in the same section. Wild animals roamed at will in the forest; the streams were filled with fish, and in such vast quantities he often selected the size and kind desired in advance of biting. In 1843 he was elected a Member of Congress from a district embracing ten counties. In Congress he at once took a prominent position, which laid the foundation for his great interest in fish and fishing, for the welfare and happiness of mankind, which followed him through the remaining years of his eventful life. He served with John Quincy Adams on the select committee on the Smithson will, which led to the founding of the Smithsonian Institution, now one of the most valuable and interesting institutions in the world. In 1847 we find him Mayor of the city of Toledo, and during this year he was elected to the Ohio Legislature; in 1848 he was elected to the Thirty-first Congress, where he took a specially prominent part in the long struggle for Speaker, receiving within three votes of being elected to that office. He was made chairman of the Committee on Postoffices and Post-roads, and as such was the author of the bill providing for cheap postage and the coining of the three-cent silver piece. Of this he said: "Speaker Cobb made me chairman of the Committee of Postoffices. During my first term in Congress postage was reduced from eighteen, twelve, ten, and six cents, according tó distance. It was ten cents for a single sheet to any part of the country. I had been corresponding with Sir Rowland Hill and was convinced that the rates of postage could be reduced in this country without incurring debt. I introduced a bill reducing the postage to three cents, a uniform rate for all distances in the United States. I was deeply interested. The main objections came from Senator Toombs, a distinguished and polished gentleman, whose principal objection was that we had no money, no change less than a five-cent piece. I knew I had to do something to offset this plea, so I went to the mint and told them I wanted a three-cent coin made. They sent me three hundred or four hundred of the little silver pieces, so I had my pockets full when Mr. Toombs was ready to make his final speech against me. I walked over to his seat, just before he was ready, and I said, 'So you 've got no change less than five-cent pieces—how do you like this for postage?' I pulled out a handful of the silver three-cent pieces and as he surveyed them carefully he replied, good-naturedly, 'I'll give up, you have conquered.' He voted for the bill. I afterwards got the three-cent pieces authorized by the Government."

It was in 1853 that Mr. Potter became first interested in the artificial breeding of fish. The successful experiments were made by Dr. Theodatus Garlick and Mr. Potter, and from that time to his death he devoted his leisure to the study and work of this interesting subject.

In 1857 he was appointed Judge of the Federal Court of Utah, but declined the honor. In 1859 he was appointed Collector of Customs for the Toledo district, serving until 1861. He was elected as Senator to the Ohio Legislature in 1873, serving until 1875. It was during this term that Mr. Potter founded the law providing, at the expense of the state, for the propagation of fish in Ohio. To his personal attention and good management the successful introduction and establishment of that policy by the state was largely due. He was a member of the Ohio State Fish Commission for as many years as he thought he could be of service to the state and people. No man took greater delight in personally watching the many changing conditions of the millions of eggs hatched out in the different hatcheries of Ohio, or greater interest in distributing small fish in the inland streams and rivers.

In addition to the national offices held by him he was at various times a member of the Common Council, City Solicitor, member of the Board of Education of the city of Toledo, and there was not a fishing or hunting club organized in Toledo but what he was asked to hold some office, and was President of one association for over twenty-five years. Such part of his time as was not occupied by his business was passed in the society of men whose acquaintance was sufficient proof of the esteem in which his talents were held, and the friendship of such men was ample evidence of his moral worth. His amiable temper, agreeable manner, and unaffected benevolence inspired all who knew him with esteem and regard. He was one of the most enthusiastic and successful anglers of our times. At the green old age of ninety he could bring to his net the gamiest black bass known in the rapidly flowing streams of our Western country, and he had that sweet and amiable disposition characteristic of all true anglers, that whether fish were wont to take his lure or not, he considered that "No recreation was so harmless and which had so many rational inducements to health and true enjoyment as angling." After a tedious winter's session of Congress he and Daniel Webster found relief in angling for salmon in the Kennebec and trout in the various streams of Massachusetts. He was a companion of John Quincy Adams and Henry Clay, and sat at the bedside of the great Kentuckian when his spirit took its flight. He was a life-long companion of the late Chief Justice Waite and Allen G. Thurman. The unselfishness of his life was most remarkable. There are different degrees of unselfishness. There are good men who are willing to devote themselves to a great cause if they may choose the part of the work that suits them ; Mr. Potter had no choice. All that he asked was that the service was needed. No life can have a loftier purpose than his. His genial sympathy and good-nature attracted every person and every interest of the whole community. No consciousness of high political honors lifted him above his neighbors. A great man is always greater than any one of his actions.

The object of the American Fisheries Society is to devise means to restore to the lakes, rivers, and streams in this country the food fish supply. The members, by study, by experiment, and intercourse with each other learned the best methods of fish culture, and by the skill which they have now acquired are able to bring into the world, by artificial means, more young fish than nature can in its ordinary course supply. Had it not been for the members of this Society, the fish industries of the great fresh water bodies, as well as the game fish for sport in the rivers and streams, would by this time be entirely demoralized, if not destroyed. Mr. Potter and Dr. Garlick watched with eager eyes the first spawn gathered in a rude box, and the result is better told by referring to Mr. Potter's address before this Society at Put-in-Bay, in 1890, where he says: "About the latter part of January the eyes appeared in the eggs, and about the first of March, 1854, there lay prone on his side, on this gravelly bed, the first baby fish artificially propagated on this continent." From this experiment has arisen an industry the benefits of which have been realized by every civilized nation of the earth. The question had attracted the attention of fishermen and the ablest scientists in America and Europe. This was the beginning of his active interest in the propagation of fish. He saw with feelings of the deepest regret that each year the hand of commerce was advancing across the waters of the Great Lakes and miles and miles of netting with its destructive tentacles extending in every direction, that in a few years our lakes and streams would be mere watery wastes. How true were his predictions we all know. In 1871 he appeared before the General Assembly of Ohio. "Gentlemen," he said, "you have but one question to consider. Shall the fish and game be destroyed from the face of the earth by indiscriminate slaughter, or shall wholesome laws be enacted, so that the future generations may share in their product? Our lakes, our rivers, and our lands are the nation's wealth. The earth only produces her fruits by careful husbandry. Shall we neglect our waters, the great source of our riches, for the want of an economical husbandry? Or shall we let them become a barren waste, when abundance awaits an intelligent cultivation under judicious and wholesome laws?"

His interest never wavered in watching the protection of fish and game.

Anent his first experiences in "the gentle art" of angling, I quote from a manuscript penned by Mr. Potter for my use when he was in his ninetieth year: "When I was sixteen years of age," he writes, "not liking farming very well I made up my mind to go a fishing to sea. I had a colt on the farm called my own, although I had never invested any money in it. This I sold and with the money I started for New York; arriving at Albany, for the sake of economy, I took passage on a lumber sloop. Down about West Point we were becalmed and laid to. After dark, it being very warm weather, the table was set in the cabin with the windows open and the lamp lighted. We were all seated around the table, when all at once a huge sturgeon bounded through the window upon the table scattering dishes and supper in every direction. He took complete possession of the cabin, much to my enjoyment. We soon dragged him on deck, and for the rest of the voyage had plenty of what the captain called 'Albany beef.' Not finding a ship in New York I worked my way to Boston, where I found, at Long Wharf, a vessel just fitted out and ready to sail for the banks of New Foundland on a cod fishing voyage. This was just what I wanted. I had caught speckled trout in all the mountain streams of New York and I ached for a taste of the gentle art at sea. I got it. I found before the season was over that the gentle art had lost its romance in cod fishing off the banks, and oh, how I longed for the speckled trout in the clear streams of my native home."

At the age of ninety-one Mr. Potter penned me the following interesting sketch: "I am often asked what has been the cause of my robust health. I can best answer by giving my manner of life from the beginning. From my early childhood I fished the cold streams of Herkimer and Otsego Counties for the speckled trout with an alder pole, with chalk line, and angle worms, and passing through all the gradations of the art up to the rod and reel, with a book of selected flies. For over fifty years scarcely a summer has passed that I have not spent several weeks on the north shore of Lake Superior amongst the trout and bass, taking in all the favorite fishing grounds from the Soo to Fort William, including the famous Nepigon. My profession, being a lawyer (I was the first lawyer that hung out a shingle in Toledo), required close application to office work, but in the fishing season, on every Saturday morning before breakfast, I took my fishing traps and spent the entire day, taking neither food nor liquors of any kind until my return at home in the evening. My Saturday's respite from office labor I continued for nearly sixty years. I can say without boasting, although nearly a hundred years old, that I see well, hear well, feed well, digest well, and sleep well, and without any organic impairment, and can keep with my bird dogs afield from morning until night. I will say for the young people, and knowingly too, that there is no sport that brings a person so closely into contact with nature at her best as angling. It first charms, and then makes the art recreation. It leads you into the woods, where you are delighted with new scenes and sweet sounds; it gives you ample exercise for every muscle of your body. The music of the mountain brook, the cool air from the mossy cascade, the scent of wild flowers and rare ferns, and the most perfect picture of woodland beauty are all the fortunate heritage of that happy man who goes a fishing."

REMARKS FOLLOWING MR. GUNCKEL'S BIOGRAPHICAL SKETCH OF HON. EMERY DAVIS POTTER.

Mr. Cheney: Mr. President, Mr. Gunckel's paper on Judge Potter has recalled several things to my mind, and among them is the fact that Ohio has been peculiarly favored in the history of fish culture in many respects. Dr. Theodatus Garlick, the father of fish culture in this country, was an Ohio man; also Dr. Sterling, probably the only American who witnessed the experiments in hatching fish artificially in France by Remy and Gehan. Some time after Dr. Sterling's return to Ohio an effort was made to connect him with Dr. Garlick's experiments. He has denied over and over again that he had anything to do with them. I have three different communications from him, in which he says that he knew nothing about Dr. Garlick's experiments until called by him into the office to see the first embryo fish hatching in America, very much as Mr. Gunckel has described the event.

Another matter which Judge Potter's name recalls to me is that a large school of small fish appeared in the lake near Cleveland during the month of March. The fish were caught in large numbers and sold on the streets. Dr. Sterling secured some of the fish and to his surprise found that they were mature fish of the pike family, although only about seven or eight inches long, the females full of nearly ripe spawn ready to be deposited in a few days. The fish had no scales on cheeks or gill covers, and from this fact Dr. Sterling pronounced them an undescribed species, as the pike, the pickerel, and the muscallonge have scales on some portion of cheek or gill covers, and named the fish after Judge Potter. The school of fish disappeared and never returned, and Dr. Sterling's specimens placed outside his library window were stolen by cats, and all he had to show that he had discovered a new species of pike was a plaster cast of a female with opened abdomen showing the ripe spawn. This cast Dr. Sterling presented to me before his death and I still possess it, but the cast is not fine enough to show the absence of scales as Dr. Sterling declared in his letter to me. He had some correspondence with all leading ichthyologists regarding the fish, including Dr. Bean, I think, but he could not present specimens of the fish, and all that remains as a souvenir of the school of small pike is the cast in my possession, on the back of which is the inscription: "Pigmy Pickerel, *Esox Potteri*, March 22d, 1877."

Mr. Mather: I move that a committee be appointed to draft resolutions expressive of our regret at the loss of Judge Potter; and also that we restore to our list of members a list of those who are deceased, after the manner of our publication some years ago. Perhaps this should be two distinct motions, however. Within three years the publication of the names of our deceased members has been discontinued. Before that time they were always kept on a roll of honor; and I move you, sir, that that roll be restored.

Mr. H. Whitaker: Before the motion is put I want to say a word. The death of Judge Potter, it seems to me, is a subject fitting and worthy of the attention of this Society in the manner indicated by Mr. Mather. We are today on the threshold of our twenty-fifth anniversary. While the legends connected with fish culture show that Jacobi, of Germany, Gehin and Remy, of France, were in advance of anything in this country in the way of artificial propagation of fish, yet nothing of practical value grew out of these discoveries for many years. Today we have a word to say with regard to a man who was one of the most interesting men connected with the genesis of fish culture, and its discoverer in this country and a witness of its great development.

I think we live in an age wherein more progress has probably been made than in the five or ten decades that preceded it. The utility of the electrical developments, the creation of the type-writer, the telephone, and a thousand other devices are well known to us all, and yet when we consider fish culture today we scarcely reflect that it is barely a quarter of a century old.

Those of us who were present at the meeting at the Beebe House at Put-in-Bay, I think were all impressed with the remarks made by Judge Potter upon the hatching of the first trout, which has been referred to in the paper read by Mr. Gunckel, and his language was most graphic. He was at that time an octogenarian, and his seemed like a face from the past to the younger members. There are other claimants for the honor, but the credit for the hatching of the first trout in this country undoubtedly belongs to Dr. Theodatus Garlick. Judge Potter described in the most graphic manner, as I say, his visit to that hatchery, if you may so term it, which was located upon a small rivulet in the outskirts of Cleveland; and I shall never forget the effect that it seemed to have upon the Society when he related that historical event.

I most heartily support the resolution, and I trust that in addition to the memorial paper that has been read connecting Judge Potter with these early experiments in fish culture, we may have a brief resolution of respect, in this way showing our regard for the Judge and for the work with which he was connected.

The President put the question on the motion of Mr. Mather, which was carried.

The President: Was the number of the committee named, or what number will you have?

Mr. Gunckel: We will leave that to the chair.

NATURAL FOOD FOR TROUT FRY.

BY FRED MATHER.

Half a dozen years ago, more or less, a fish culturist in Europe published an account of his experiments in rearing trout fry on natural food, which he had learned to produce in great quantities by a process which he would not divulge. His system included a supply pond, where the living food was bred, and a series of small pools, which served as temporary pastures for the fry until the food in one was exhausted, when they were to be driven into another pond, as cattle are changed from one pasture to another. This man's article was translated into many languages and was published either in the Annual Report of the U. S. Fish Commission or in its Bulletin. At present, while writing this article, my library is packed away and it is not possible for me to quote the volume or to give the name of the gentleman who originated the idea, but I have stated his main plan and remember that the secret process of growing live food was offered for sale to me, as no doubt it was to other fish culturists, but for two reasons I paid no attention to the matter; one was that I never cared to buy any secret, and the other that the plan seemed to be impracticable on any scale such as we use in America. The plan of driving small trout from a grassy or weedy pond condemned the whole thing, because they do not drive well, and in such a pond many would remain and keep down the expected increase of food, and so the wonderful scheme was dismissed from serious consideration.

A while after the first announcement of this discovery of how to rear trout without expense, it leaked out that the process was to use the dung of animals in water to grow diatoms by the million, and the diatoms in turn would furnish food in plenty for the smaller crustaceans, as daphnia, cyclops, gammarus, and perhaps other forms of life on which young trout thrive in a state of nature. This was perfect in theory, but I still was skeptical as to its value in practice, and the scheme passed from memory until it was brought before this Society two or three years ago and lightly discussed. You may remember that Mr. Frank N. Clark said that he had experimented a little in this direction with several forms of ordure, but had produced no results that were satisfactory to him. Last summer I had leisure to try this scheme, and will give the result of the experiments.

There was a dripping fountain in my yard supplied from springs in the hill above, which also supplied a portion of the water used in the state hatchery, on lower ground. This fountain was supplied by a ¾ in. lead pipe, and the water trickled and dropped over rockwork into a basin, and from there the overflow went through a series of small pools in my garden, where the year before several species of wild ducks had been confined. An examination of the water in the first pool and also in the small open pond above, which caught the flow of the several springs, revealed the fact that it contained the forms of minute life named above, as well as rotifers, hydra, snails, and several kinds of water insects, as well as their larvæ. Therefore, all the conditions seemed favorable.

For the benefit of those who have paid no attention to the minute forms of life which it was proposed to breed, it may be well to say that diatoms are invisible to the unassisted eye except when in mass, as we often see in swamps, where they appear as an iridescent scum on the surface of the water in still places or in the spoor of some heavy animal. They were formerly supposed to belong in the animal kingdom, but are now classed among the lower forms of algæ, and have a shell or case of silica, which passes undigested through fish and turtles. These diatoms form the principal food of the oyster, and naturalists have recorded and named something like 4000 species of them, but we will not go into the subject so deeply. Suffice it to say that the microscopic vegetables can swim in most cases and supply food for animals also microscopic in their young stages, such as the daphnia, cyclops, and other forms of entomostracans which in turn feed young fishes.

To be complete such experiments should begin in February, when the earliest trout of the year may begin feeding; but these experiments began in April, in time, however, for the production of food for the later hatch to get their first meal. The water now on Long Island was a trifle warmer and presumably more favorable to the production of such life as was desired. The temperature of the water during the season was as follows, mean temperatures only for each month being given in scale of Fahrenheit:

	Rockery.	1st Pool.	2d Pool.	3d Pool.	4th Pool.
April	56.5	58.10	59	59.75	60
May	58.5	60	61.25	62	62.10
June	62.75	64.10	65	65.75	66.25
July	69.25	73.25	75.10	76	78
August	72.75	74.5	76.25	76.75	77.50

With August the record ended. Neither time nor inclination allowed further observations, for the season had covered the production of food during the most critical period of the life of a baby trout.

The "Rockery" received the first water from the spring pond, already mentioned, and in the basin at its top was placed both old and fresh cow ordure weekly. In the first pool there was a division of the water, and in one half horse dung was frequently put, both fresh and stale, and in all the pools was a deposit of duck dung of the previous year, well dissolved, and stocked with all the forms of life which it was thought desirable to cultivate. At different times water was taken from each of the five places in this way: One gallon from the surface by immersing the measure, one gallon from the middle and one from the bottom by means of tubes, and the contents filtered through No. 8 wire cloth, cheese cloth, and then through the finest of mill silk bolting cloth. The last would retain almost all but the smaller diatoms, and they were caught in a funnel of filtering paper below all the other strainers.

This work, being done twice each month for the five months including April and August, should give a fair average of the amount of food in the pools during the season in which the operations were conducted. The following gives the amount of entomostracans obtained, and excluding snails and the diatoms. In other words, the amount of food available for trout fry in their first season, such as they can see, seize, swallow, and assimilate. The pools contained about 150 cubic feet of water, or 1125 gallons, of which 15 gallons, or $\frac{1}{75}$, were strained on ten different days, at the 1st and 15th of each month.

Of the above-named food 2.25 grams were caught, equaling .225 grams per day. This multiplied by 75 gives us 16.875 grams for the entire water per day, and again multiplied by the 153 days gives a total of 2,581.875 grams in the whole season. Dividing this by 24 gives us 107.578 oz., a trifle less than 6¾ lbs. avoirdupois.

We must consider the fact that no fish were feeding in these pools, and that the calculation is made as if the animals lived only one day and were replaced by others. This is not the fact, and how long they may live I cannot say, but if each individual lived a week the amount of food produced would be less than 1 lb. in the entire season, as the calculation is for a daily renewal of all life. Two hundred baby trout could have lived there during the first week of their lives and fed well; after that time, when their appetites began to get sharper, say in a fortnight, all the food to be found would be just what came in the water supply, and that would not have fed half a dozen when two months old. If I had been skeptical of the practical utility of this scheme before this experiment there has been nothing to convince me of error; still, if other trials under other circumstances show that it is practicable to raise enough natural food to rear 20,000, or even 10,000, to be six months old, I must try the plan which has proved to be successful. While writing this I do not know that any other men but Mr. Clark and myself have worked in this field in America, still it is to be hoped that they have done so and that they will publish their experience. Such work is very interesting to one who has a taste for it, as most fish culturists have, and this paper may stimulate others to similar trials. I think one plan was to have a number of separate ponds in which to breed the food and to tap them in succession, and allow each one to furnish food to the fish, which were not to be driven to the pasture, but to remain in one pond and get the food supply from different sources at different times. This is certainly the best plan, as any trout breeder will certify, because it is a difficult matter to get the last dozen trout from a pool containing vegetation or hiding places of any kind. At present writing I have less faith in the scheme than when I began to experiment with it.

DISCUSSION ON THE PAPER OF MR. FRED MATHER.

Mr. Mather: I wrote this paper on this subject, and I have been trying to find out if I had changed my belief. I did not believe in the thing, and considered it a humbug; still, as it has been published far and wide, I wanted to see what the results of my experiments would prove; and I am still convinced that the whole thing is as much of a humbug as it struck me when I read the first accounts of it.

Mr. Titcomb: Have you tried the effect on the fish in the old pond, where the temperature was seventy-seven degrees?

Mr. Mather: Yes, they lived there in warm weather. As I understand this man's plan, it was to have the reservoir in which to breed the food, and then let a little stream go through and carry the fish into the colder water, where the trout were. Most of them, you know, are very small, and they live in water of a great many different temperatures; and while they were bred in this water, these pools in August were too warm for trout, but not in the early part of the season, up to July.

Mr. H. Whitaker: I do not care to start a discussion on this paper, but there seems to be no disposition on the part of any one else to do so. I think it is a paper that should challenge the attention of every fish culturist in America, and I think the thanks of the Society are due to the author for bringing a subject of this kind up for discussion here. I believe it must appeal to every man interested in fish culture that there is a great sentiment today in this country in favor of the artificial breeding and rearing of trout for the market. I believe it is the proper function of boards of fish commissioners, and particularly the United States Commission, to investigate this subject.

We do know that liver fed trout are of little account for market fish; you must give the natural food of the fish to them, in order to get a marketable fish and an edible fish. There is no question that in Germany, in Scotland, and in England this subject has received great attention, and that fish culture has been entered upon by private individuals in these countries, I believe, with profit.

It seems to me that with the large amount of means at the disposal of the United States Commission they ought to take the lead in investigations looking to the rearing of trout for the market. There is hardly a day passes in the experience of any man connected with the industry, I fancy, that he is not inquired of with regard to this subject of raising fish for the market. I believe that Mr. Mather's experiments go to show what he states they do, and that such progress is being made in this line as necessitates just such experiments as Mr. Mather has made. It is only a step, but I am satisfied in my own mind that within the next decade or two, if this matter is properly followed up, we will have many waters under private control in all the states of the Union that will produce a great many pounds of fish annually, to the profit of the men who own the ponds.

I have no doubt that many of you have seen the most valuable book that has been called to my attention within the year, published by Mr. Armistead, "The Angler's Paradise." In my opinion it is one of the best books on fish culture that has been published. He deals largely with this question, but does not go into details in regard to it; but that he is running a place in his country, at a profit, is beyond question. Now, considering that America has not advanced as she should in the artificial propagation of fish for distribution in public waters, it seems to me that it is incumbent upon us as fish culturists to take the matter up and follow it out and if possible make it a success. There are certain objections, undoubtedly, to the marketing of fish by private individuals; but the public good must first be given attention. If barren waters can be made productive, so much has been gained, so much has been added to our substantial food economics. I think if this matter is followed out a just conclusion will be reached, and some will, at least, reap the glory of having bred and reared enough of the food of fish to make the breeding and marketing of fish a practical thing in this country today; and I would like to hear from some others on this subject.

Mr. Mather: I would say for the benefit of Mr. Whitaker, that Mr. Hansen, a member of this Society, whose address has escaped me for the moment—

The Secretary: Mr. G. Hansen, Osceola, Wisconsin—

Mr. Mather: Mr. Hansen is now breeding trout for the market profitably, he writes me, and it was a question with him whether he could reach the New York market. He says his market is limited. He can raise any quantity of trout, but cannot get the price for it. There is no demand for them in his section. A few hotels want them, and he wrote to me to see if I could make some arrangement whereby he could ship the trout to the New York market. He has got more than he knows what to do with.

Mr. Whitaker: Does he raise them on this kind of food?

Mr. Mather: No, not on this kind of food.

Mr. Whitaker: What kind?

Mr. Mather: I cannot tell you.

Mr. Whitaker: If they are fed on liver he will not find much of a market for them in New York.

Mr. Mather: I am not willing to agree that liver fed trout are not good trout. I find them good to eat. Liver is a pretty good article of food, and I can make a good breakfast on liver. There is a kind of sportsmen who go into the streams and get wild trout—I have myself gone into the woods hungry enough to eat a jackass, and cooked my own trout and eaten it half raw, and declared that it was the finest trout ever cooked on the face of the earth—but if a man ever served it to me in a New York restaurant, it would be sent back. I have eaten trout fed on liver that I consider good trout.

Mr. Titcomb: I have been interested in the remarks on the subject of natural food for trout, and on the subject of marketing trout. I have been interested in a hatchery unfortunately so situated that at certain seasons of the year the water is more like mud than water; but I have found that if the eggs of the trout and the fry be carried beyond the sacking period, the mud is full of food for them.

I have not experimented as Mr. Mather has in confining the fish and getting at the actual supply of food. I could only gather my knowledge from the action of the fish themselves. The stream I refer to flows in a valley for a long distance, and has the water shed from both sides, and it seems to get all the fertilizer which is put on the farms above the station, and therefore in a way the fish get the natural insect food, but there would be days, you might say a week at a time, when the water would be so impure, so roily, that the little fish could hardly be seen. During these periods it did not seem necessary at all to feed them. They did not seem to care for the artificial food, but were lively, keeping up toward the head of the stream as if all the time on the alert for food, natural food, and I found that they thrived in that way nicely.

I feel very much as Mr. Mather does, that this question has not been solved, and that we must make a study of it in the future; but from my experience in the plant referred to, I am in hopes that it will be solved some time, and that we can find a natural food.

Relative to commercial hatcheries, I have visited several that are commercial hatcheries, notably those of Mr. Hoxie, at Carolina, R. I., Mr. Gilbert, Plymouth, Mass., and Mr. Hurlbut, at Freetown, Mass. Of these three, the one at Carolina and the one at East Freetown, the food supply at those stations is entirely liver. At Plymouth Mr. Gilbert has a more natural preserve for his trout, that is, the waters approach more nearly to nature. They are located in a cranberry bog—some of you may have seen them. He makes quite as much out of his cranberries as from his trout; but in addition to the large pond for the preserve, he has a long stream, which affords a flow of water naturally through the bog, marshy on both sides, the natural substrata of soil being sand; but on each side of the stream, if you step off the plank walk, you get into the water. It is very wet. You turn up any of the shrubbery growing along the bank of that stream and it is alive with shrimp. Mr. Gilbert claims that the trout in that stream get as much natural food as the food he gives them, which is artificial. I have eaten trout taken from his ponds which appeared to me as good as natural wild trout; and I have eaten trout from Mr. Hoxie's ponds, and I must confess I could not tell the difference between those trout and wild trout.

I have eaten trout weighing two pounds—that is to say, a part of it—which was kept at the State Hatchery in Vermont until they weighed two pounds, during the early season, when the water was cold, which seemed to be as good as any wild trout. In speaking of wild trout, we know that the wild trout in different waters will vary as to quality of food. If you take a wild trout from stagnant water where the food is plenty, they do not seem to taste as good as trout taken from more lively, cooler water. I simply bring up this experience to add to what Mr. Mather has said.

Mr. Mather: There are three mill ponds. In the upper one, the trout about the first of April and along through April are quite edible; from the first of May, after the rains get started in, the trout taste muddy, taste like good fresh water fish out of a muddy pond.

In regard to the natural food, of course there is enough natural food in almost all the streams to support a limited number of trout; but the point of my remarks and my paper was this—that where you have ten thousand trout, say in a little artificial pond, perhaps not over twenty-five feet by ten feet and a couple of feet deep, and they are about as thick as they can stand and swim, they have got to have a good deal more food than will go into the water naturally; you cannot breed in any such pond as I undertook to work this last year.

Mr. Titcomb: You must have a greater water area?

Mr. Mather: Yes, sir.

Mr. Annin: I would like to say a few words. I agree with Mr. Mather. I do not think it is possible for any one to breed naturally food enough to run more than a small pond, where you are rearing ten or twelve or twenty thousand small fish, and to support them. You have got to have them artificially fed. You see in the fish business the rule is to make money, sell trout; and upon inquiring into the circumstances connected with it, invariably you will find that they have a big pond, and a pond that is breeding natural food itself, and does it to such an extent as to produce natural food enough, so as to carry lots of trout. I think you would find in many cases that they can raise natural food to run through and feed your fish, so that you can produce enough of them to make it pay. Mr. Hansen, in Wisconsin, is feeding natural food, that is, allowing natural food to pass through the pond. He gets the benefit of that, and he also is feeding them. He is feeding everything that he can find in the way of artificial food.

Mr. Whitaker: There is a misconception regarding the point we are getting at; at least so far as my remarks are concerned. I would not suggest for a moment that this matter of natural food should be gone into in connection with fish culture in ponds. That is not the point. We can carry all the stock fish we want under present conditions with liver fed fish; but that is not the question. The question is about rearing fish for market by the individual. There is no question that with the proper amount of air and with the proper installation of aquatic plants in ponds, you can very largely, and perhaps altogether, furnish the amount of food that is necessary for the sustaining of trout and to bring them into excellent condition. But what, it seems to me, we ought to look into is the question of adding, if it can be, to what these persons who have been experimenting in this line claim to have done here. I believe that something still may be added, and that is one of the things we ought to give attention to.

I agree with Mr. Annin in his remarks and with Mr. Mather; but I believe that Mr. Annin admits that no fish culturist who carries his stock fish in ponds can be bothered or embarrassed with aquatic plants or anything else. He must have his pond in such order that he can handle them, and they must be liver fed. The writer of the paper said he was so hungry he could eat a jackass, and did eat a fish that was partly raw. I do not believe it is necessary to pass judgment on that kind of an epicure, and therefore I shall have to dismiss that part of the subject, because he carries a stock in his pool.

Mr. Cheney: I do not know who the foreigner is that Mr. Mather referred to, but it may be Mr. F. Lugrin, of Switzerland. His process has been published in the bulletin of the United States Fish Commission and also in the proceedings of this Society, that is, so much of it as is known to any one but the inventor. I think it was copied into our records two or three years ago.

There is a gentleman now in Europe who has been investigating Mr. Lugrin's methods. He cultivates about one hundred thousand yearling trout annually, and he rears his trout on small insects, daphnia, cyclops, and fresh water shrimp. The gentleman referred to who is abroad investigating the matter is a director of the Adirondack League Club, and is expected home within the next month, when he will bring home with him all that he has been able to learn about the matter. The inventor of this process, if it may be called so, and he does call it a secret process, declares the details of rearing the trout food has never been given out to any one. Visitors have come, observed, and gone away; but he has never had occasion to give its details to any one. I am waiting with considerable interest to see what the New York investigator will report when he returns. He writes that the plant can be enlarged. It is a mere question of adding to the rearing troughs or basins. Lugrin's plant provides for rearing only 100,000 trout a year, as that is all there is demand for in Geneva, but he claims that it is only a matter of increasing the number of food basins to enlarge the plant to a million or more fish, as the basins create their own food. There is another foreign experimenter whose methods are similar in one particular at least to those followed by Mr. Mather in his experiment, and this is Carl von Scheidlier, an Austrian fish breeder, but he professes to have several methods. All of these secrets all grouped under what is called the von Scheidlin-Rakus system. As near as I can learn from correspondence this system is entirely different from the method followed by Lugrin.

Mr. Thompson: I have had a little experience with trout fry, and I believe it is the same with trout fry as with a child, horse, cow, or any other living thing. Taking trout fry in quantities such as a man will have to raise for a state hatchery or marketable purposes, it is impossible to get the amount of natural food out of any place where you can put the fry to grow them. Take a child or a colt aad starve it in its youth, and it will be a starved man or horse to the day it dies. It is the same thing with trout. You can take trout fry and feed them and take care of them and grow them ; I don't care what the food is you feed them, provided it agrees with them and they get enough of it to live on, they will go ahead. Of course, if you can give them natural food, so much the better. But my experience has been within the past few years, and I have had quite a little—and I can show you this year's trout three inches long—

Mr. Cheney: Three inches?

Mr. Thompson: Yes, sir. I will do it tomorrow, if any gentleman cares to come with me. I will show this year's fry three inches long. They have not received any artificial food so far, and I will show you thousands of others that are fed and taken care of, running from one half to two inches long, and I will show you year old trout weighing one quarter, three eighths, and a half-pound.

They are fed from a series of ponds. I will show you 20,000 fish in a pond not much larger than this room, very little, if any. I will show you a fish that will average from a quarter to a half-pound. This fish has been fed regularly. When a man says that he cannot raise trout, and raise them profitably, in my opinion it is because he does not pay attention to it.

If you will feed a child once a day, it may live and get along in a certain way, but if you feed it three or four times a day it grows better; and if you will devote the same attention to fish, and feed them often, I think you can raise fish fast and profitably.

The place I have reference to is on Long Island, well known to very many here, I presume. We do not feed to the fish which we eat any artificial food whatever. We grow a fish until it is half an inch, and then turn it down to the lower pond, and they do not get any more artificial food. We do not feed any artificial food during the month of October, when we prepare to turn them out to spawn and let them go down to the lower pond. In the upper pond we feed and grow our fish as fast as we can, until we get them a size large enough to catch, and then we let them down to take care of themselves. In that pond we have the tide water. The only thing between our lower pond and the tide water is an inch mesh screen. The tide ebbs and flows into that pond the same as in Long Island Sound. We have a pond about one hundred feet wide and twelve hundred feet long, and in it there are about 20,000 fish; and I guarantee that you cannot catch a poor fish in it, one that is not in flavor and condition equal to any fish, I do not care where you look for them. This has been our experience, and I would like to have any gentleman in this room visit the place and take a look at it.

Regarding this animal food, etc., I cannot talk from experience with our fry. It is getting this animal food. There is a little spot where I put down a six-inch pipe and get fifty gallons of water a minute, just as clear as air, and there I have my fry. They are doing well. It certainly is not from the manure that washes down or anything of that kind. I will show you fry that have never had a particle of artificial food; and I say that they are away ahead of those that are fed. Of course, there are not so many in the same space; but in a space four feet wide, twice the length of this room, there are probably two thousand that are left there, that I did not get into the artificial strip and hatch.

I believe with a hatchery eight feet wide and four hundred feet long, with plenty of spring water, all that is necessary is to pull up the screen, and simply let enough fish go in in two hours. I put in six inches deep of clean, white beach gravel, and let them go in and deposit their eggs. I let about two thousand fish go in there. Of course, we do not get as many fish as some other fisheries do. We calculate only to raise about ten thousand fish a year, which is as much as we care to have; and we have, perhaps, thirty thousand fry that are fed artificially. The natural fed fish are certainly ahead, but it is true that they have a little more space. I do not care how much you feed artificially, I do not think it affects the flavor of the fish in its early stages of growth. You should feed them for the first year, and get them so that they will be a good size. The first consideration for any person who wants to raise fish for market is to get size on them, and then there is enough natural food to be had for fish. If a man raises fish for the market on the border of the seacoast he can get any quantity of minnows and shrimp. I have found a good way to grow fry—it may not be convenient for you all to do this—but I can find any quantity of large minnows, almost as large as your finger, and you can catch a bushel of these, put them in a barrel, and run in a little jet of steam; and in about an hour you can steam them so that the meat will peal off from the bones, and you can give the natural food to your fish. You can take and do the same thing with your large fish, and you can grow them and grow them profitably. A man can grow fish for the New York market and make money.

Mr. H. Whitaker: You advocate taking as much care of them as possible for the first year, to give them size, and then turning them out for natural food?

Mr. Thompson: Yes, sir; I agree with Mr. Mather that liver tastes good sometimes, but we do not believe in paying a dollar a pound, and you and I and any man knows we can buy liver for less. We like good calf's liver, but we like other things with it, a little salt and pepper, butter, and a nice piece of bacon fried with it, and then it may be very good, provided we are hungry; but when we go into a place and sit down and pay a dollar for lunch, we do not care to have liver fed fish. We like a natural trout. I can easily detect the difference between a liver-fed fish and a fish fed naturally from a river.

Mr. Titcomb: You have spring water, and food naturally coming from the water, as I understand it, out of the ground?

Mr. Thompson: It bubbles right up.

Mr. Titcomb: Apparently a natural spring?

Mr. Thompson: An artesian well. We feed that artificially.

Mr. Titcomb: I thought you said they got their own food.

Mr. Thompson: There are some on the side pond. I will refer to an experiment we have been trying this year. We thought that probably we took a little too much pains to clean our ponds out too well. I found a little place that was made a year ago. I tried to grow some there, but did not have as good success, and did not grow them as fast as I did this year, and the place has not been cleaned within the year, there being a certain growth of fungus that comes up, water grass, etc., and we let it stand and it stores more food for us than in years before.

Mr. Annin: I think it would be right to correct one opinion that might go out in this discussion. I think all the old fish culturists are acquainted with the fact that there is no water in the United States so good to grow brook trout as the water on Long Island. There are no waters that are tide waters that have got the amount of natural food, and where the temperature is so favorable, and the trout will make such growth, as they will there. Going up into Western New York or Michigan, it is impossible to bring fish to that size in the same length of time, I do not care how much you feed them.

Mr. Thompson: You will have an opportunity tomorrow to see ~~your~~ two old fish that will measure nine inches in length.

Mr. Annin: I do not doubt that in the least. Ten years ago I saw trout near Jamaica that weighed half a pound, and was only one year old. I would not believe it until I was satisfied the man was telling me what was the truth. After that I investigated more about the growth of trout on Long Island and I am satisfied they cannot say too much about them.

Mr. Thompson: I raised a fish and sold it to Mr. Blackford a number of years ago—the first time I met the gentleman. I went into the experiment some fifteen years ago, and sold him a brook trout weighing four pounds ten ounces, just three years old, raised from the egg.

Mr. H. Whitaker: Mr. Annin's remarks are quite applicable. I have a vivid remembrance of our visit to the South Club on Long Island, something like two years ago. The fish shown there were a revelation to me. I never saw anything to compare with their yearling fish and two and three years old fish. They were marvelous. In the interior it is impossible to do it. There is no question that fish having the advantage of going to tidal water have a far greater growth than fish that are confined entirely in fresh water. That accounts for the marvelous growth that Mr. Thompson refers to, undoubtedly.

Mr. Mather: While on this subject, I was in hopes that somebody from the United States Fish Commission would be here today who could tell us about Mr. Page's success. He is advocating the feeding of mush; I think he uses middlings, mixes it with his liver and other things. He is the only one who has advocated the feeding of any vegetable food to trout, and I should like to hear from some one who knows something on that subject.

Mr. Thompson: I can answer the question of my friend in regard to feeding mush. I had a gentleman ask me that question, what I was feeding my fish on, and I told him Indian meal. I was doing nothing of the kind. He had a pond with a number of fish in it, and that man went home and boiled Indian meal and fed his fish on it, and he is feeding it today; and I have to state that he has as fine fish as any in the state of New York. (Laughter.) That man supplied the Waldorf with trout grown and fed on Indian meal. It is a fact. I will tell you what he did with it. He did not feed liver, and I have never fed a pound of liver in my life. I take clean beef hearts and lean beef and grind it up as fine as I can. He took these beef hearts and ground them up, and would put probably four beef hearts in a large kettle that he had, and boil it thoroughly, and after he got it thoroughly boiled, thicken it with Indian meal. I never saw fish, as many in the same space, that grew as these fish did.

Mr. Annin: I used Indian meal in two places for one year. I cooked the meal separately, but it is not a success unless you cook it rather thick. When it is cool and it is not thick, it will give with the water; a big fish will strike at a chunk, and what he gets in his mouth he will take, but the rest will settle down. It is a bad thing for a small pond. I have given it up.

Mr. Thompson: This gentleman has not given it up. He feeds it every day, and has done it for the last two years. One year he reared about thirty thousand fish in a pond certainly not more than twice the size of this room. He is still feeding the Indian meal.

Dr. Bean: I can answer one of Mr. Mather's questions about the result attained by Mr. Page in feeding rainbow trout with mush made of mill middlings and mixed with liver. I have been at Mr. Page's station, Neosho, Missouri, and have seen there hundreds of rainbow trout twelve months old, which would average pretty nearly twelve inches in length. That is, I think, rather unusual. He gets larger fish, but these, I am quite certain, averaged as much as twelve inches at twelve months old. I do not believe that any other trout than the rainbow will take this diet and thrive upon it equally well. It may be that the brook trout will eat it, but Mr. Page did n't succeed in getting such results with any other than the rainbow trout. He cooked the middlings thick, mixed raw liver with it afterwards, and fed it thick. I have seen the trout rush at it as if it were *gammarus* and *daphnia*, or anything they are supposed to like better than any other food.

Mr. Annin: I fed fry two months old, and used bolted middlings, same cooked separately, and passed it through the finest blade in the meat chopper, thirty-second of an inch blade, mixed with the liver, and when it came out it was thoroughly mixed. We would feed our two months old fry on it. That did very well, but we had to be careful about the troughs. It would slime the whole bottom of the trough.

Mr. H. Whitaker: We do not know what can be done until we find out. Mr. Thompson is a benefactor to his race, but he did not know it at the time. On the question of feeding meal middlings, my attention was called two years ago to an experiment made by a man who had nothing to do with fish culture; and in some place down in Indiana—and Indiana's waters are not first-class—was the owner of a grist mill. Under conditions that were purely artificial he introduced into his pond white fish, and he has been feeding them on cooked middlings, I think, mixed with liver or something else, at any rate, largely middlings, and it is claimed to be a great success; so that we do not know what we can do until we try.

Dr. Bean: That is Thompson, at Warren, Indiana.

Mr. Whitaker: I understand that it is a fact.

NEW METHOD OF POND CULTURE.*

BY DR. JOUSSET DE BELLESME.

(TRANSLATED BY DR. TARLETON H. BEAN, DIRECTOR OF THE NEW YORK AQUARIUM, BY PERMISSION OF THE AUTHOR, AND READ AT THE 25TH ANNUAL MEETING OF AMERICAN FISHERIES SOCIETY.)

[At the solicitation of Count de Briey, President of the Central Society for the Protection of Fresh Water Fisheries of Belgium, M. de Bruyn, Minister of Agriculture, requested Doctor Jousset de Bellesme, Director of Fish Culture of Paris, to deliver a lecture on pond culture at the Exposition of Fisheries and Fish Culture at Antwerp in 1894. That lecture was published in the journal of the Belgian Society mentioned, in January, February, and March, 1895.

Dr. Jousset de Bellesme had previously published a brief account of his new method of pond culture in *Comptes Rendus Acad. Sc.*, Paris, Nov. 26, 1894. A paper upon the same subject was published in a French newspaper, *Le Gaulois*, by A. de Marcillac in March, 1895, criticising the method proposed by Dr. Jousset de Bellesme, and in *Revue des Sciences Naturelles Appliquées*, Paris, No. 17, December, 1895, M. Jules de Guerne takes exception to the statements made by the Director in terms unnecessarily severe;

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* Nouvelle Méthode de Culture des Étangs, Par le Docteur Jousset de Bellesme, Pêche et Pisciculture, Brussels, Nos. 1, 2, 3, Jan.-Mar., 1895, pp. 2-11, 28-40, 50-54.

indeed, in such a manner as to arouse suspicion of an unworthy motive.

There is no question as to the value of the experiments herein described, and however much American fish culturists may differ from some of the distinguished author's opinions, they cannot fail to find in the article many useful hints for their guidance. We have to thank him for the information that the quinnat salmon will reproduce without going to sea when three years old and weighing thirteen to fifteen pounds, and that they can be successfully and profitably reared in ponds.—T. H. B.]

In Belgium, as well as in France, ponds have not taken the rank to which they are entitled in increasing the food supply and supporting industries because, instead of constantly improving their system of culture, the breeders of fish have remained hypnotized by obsolete methods, and have found nothing better than the indefinite perpetuation of the carp, which has been practiced from the thirteenth century.

It is desirable to abandon this plan and in this progressive age to give up ancient errors. After I have shown the result of the extended researches which I have made into this interesting subject, I hope all your doubts will be removed and you will be convinced, as I am myself, that pond culture is susceptible of taking its place in the first rank of fish cultural industries.

At present it is rare that a pond suitably located yields sixty francs per hectare of surface, and again how often they do not give more than a revenue of thirty or forty francs per hectare every two or three years. It will be admitted that with such meagre returns this industry will be greatly neglected.

I hope to demonstrate to you that if this had been differently managed the culture of the pond might be made to yield seven hundred, eight hundred, or even a thousand francs per hectare.

I will divide my subject into two parts :

First : I will give a rapid survey of the present state of pond culture.

Second : I will have the honor to show you the new method which I have evolved from experiments continued about ten years at the Aquarium of the Trocadéro in the rearing and reproduction of the Salmonidæ.

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I have often asked myself why the monks especially selected the carp among the numerous fishes which inhabit our fresh waters. Of course we can offer nothing but conjecture upon this point. My belief is that the carp of the fourteenth century was not exactly the fish which we know today, and that it was distinguished then from other species by qualities which it no longer possesses.

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I fear that what I am going to say will excite contradiction, and I will be sorry if any one attributes to me bad intentions with regard to a fish which gives pleasure to the angler and is sought after by many people ; but the love of truth leads me to state that from the culinary point of view and as a food the carp is far from occupying the first place among the fresh water fishes which are offered in our markets. It ranks in the quality of its flesh below the salmon, trout, eel, and frequently even the perch, gudgeon, and barb. If any one disbelieves this statement it can be sustained by a glance at the list of prices of fish in our markets. It will be seen that while a kilogram of salmon costs ten francs, of trout eight francs, of eel seven francs, and of gudgeon five francs, a kilogram of carp costs about three francs. These are the average prices of the Paris market. Three francs a kilogram ! Who hopes to establish that at this price the carp is an advantageous food ? Leaving out the always disputed question of taste, the food value of the fish must be considered:

Buy a carp of one kilogram; cook it; it will not weigh more than		991.80 grams
Remove the skin and weigh it; it is	96.90 grams	
Take out the viscera, which weigh	379.76 "	
Carefully remove the skeleton .	201.78 "	678.44 "
There remains of flesh only		312.36 grams

Thus, from this fish for which we have paid three francs, we obtain only three hundred and twelve grams of flesh; that is for the flesh almost at the rate of ten francs per kilogram.

If we take a salmon or a trout of one kilogram, see what we obtain; after cooking it weighs . .		965.70 grams
Skin	49.90 grams	
Viscera	199.80 "	
Skeleton	122.10 "	371.80 "
Flesh		593.80 grams

It is unnecessary to emphasize further the inferiority of the carp.

How then comes it that, in spite of this inferiority, which has doubtless been remarked and commented upon by many other persons than myself, the carp still continues to be the only fish cultivated in ponds? There are several reasons for this; the carp really possesses several valuable qualities from the point of view of the fish breeder. Of all our fresh water fishes its growth is the most rapid. At four years it weighs two kilograms, and frequently arrives at this weight earlier.

It is extremely hardy and is not injured by freezing nor by impurities in the water. Its culture is attended with uniform results; finally, the carp requires less care than other fishes. Its food is vegetable, and one may really say that this fish raises itself. This, indeed, is the principal cause of its success; many proprietors are satisfied with small results upon the condition that they do not cost any trouble.

I said at the commencement that this method is to be abandoned. Every medal has its reverse. We may say that the hardiness of the carp has been the origin of its degeneration as a species. The fish culturist grows careless about the selection of the breeding fish, and very often before having his attention called to it the carp have spawned in the pond quite promiscuously. Nevertheless he sells the young for re-stocking at the same price as if they had been of a good race; also through this negligence the pond deteriorates, as in Sologne, where the carp has greatly degenerated and has acquired a factitious quality of reproducing too early. The Sologne people have remarked upon this without comprehending its significance. They say in this connection that the carp is precocious.

As a result, it frequently happens that the alevins placed in a pond to grow begin to breed before they have reached a marketable size, and they have no commercial value. This characteristic has been acquired by living many generations in ponds which are too warm, and has become fixed by heredity. High temperature stimulates the reproductive functions and the animal becomes incapable of growing large.

Is it advisable to cultivate such a mediocre fish? Here are some figures which will answer this question, and without burdening you with a long and detailed enumeration I will furnish the two extreme terms of this series.

First, the minimum.

In 1892, in Sologne, the proprietors of ponds had difficulty to sell carp at seventy centimes a kilogram. After deducting four per cent. and the expenses of fishing, which would give about fifty-two centimes a kilogram, and as a hectare produced an average of not more than eighty kilograms, this is a yield of about forty-five francs a hectare; but it should be noted in this regard that the ponds are not fished oftener than once in two or three years. Certainly this is small, and indeed some ponds return sixty, seventy, and even eighty francs per hectare.

The most highly esteemed carp establishments are those of Dubisch in Silesia, which have frequently been mentioned of late years, and have given the best results. A hectare has yielded, according to official reports, as high as one hundred and thirty-two francs, a result which has never been exceeded; but this method involves much care and labor. This is a very excellent result, but how insignificant compared with a yield of seven hundred francs per hectare, which I have mentioned in the beginning. Truth compels me to say that it is not with the carp that this climax is reached, but with another fish.

I have thought from the beginning that it would be possible to replace the carp by another of our fresh water fish, such as the eel or trout, the prices of which are much higher.

For the culture of the eel special conditions are essential, and the habits of the fish are such as to make its culture in ponds uncertain and undesirable.

On account of its high price the trout has already been made the subject of many experiments, but of all those I have seen undertaken I have not observed a single one which has been a success from a commercial point of view. The reason can be easily stated:

First, the ordinary pond rarely contains water of a temperature during the summer sufficiently low to suit the trout or even to keep it alive, for this fish will not endure a temperature above 18° centigrade; besides, the calm and stagnant water of the pond is not calculated to please it.

It is a fish of rapid streams, of waters incessantly moving and aerated, of the rapid cascades which it ascends joyfully even when they boil like a cauldron;

finally, it is a carnivorous fish, a great feeder, and when at liberty in a water-course it has the habit of migrating if a sufficient supply of food is not present and establishing itself elsewhere. In a pond the trout is a prisoner and it must submit to the conditions imposed upon it, and these do not agree with its independent spirit. When the small fish available for it are exhausted, and they are rapidly exhausted, the young come to a standstill and the fish are reduced to insect food, scarcely sustaining themselves, and do not grow any more.

Add to this the fact that the breeders who have made these attempts and who have favorable conditions for the fish have made a mistake by attempting to cultivate the trout by methods which they apply to the carp. This is a fundamental error; a carnivorous animal will never accommodate itself to the mode of life or conditions which are suitable for herbivorous ones. For all these reasons the rearing of the trout in ponds, though often attempted, has not become current among fish culturists. Still I am convinced that under favorable conditions this rearing will be possible, but it will be necessary to follow a totally different method.

I have in my experiments here been greatly aided by the importation of Salmonidæ, which have furnished the means necessary to resolve this problem by having placed in my hands a fish of superior delicacy of flesh and combining all the qualities desirable for pond culture.

In 1879, the Aquarium of the Trocadéro received, through the courtesy of the U. S. Fish Commission and at the request of the National Society of Acclimatization, the eggs of three species of salmon successfully cultivated in America.

I devoted myself ardently to the rearing of these fish with the object of introducing and acclimatizing them in the waters of France. I have rested my hopes upon two of them, for I have not been misled as to the difficulties inherent in this experiment. But the way being prepared I have not lost sight of pond culture, and as I gradually learned more of the habits and characteristics of these new species I have not been slow to remark that one of them combines the qualities which make it suitable for simple and economic culture, and that by modifying the methods one may secure a new pond fish, the cultivation of which will be infinitely more remunerative than that of the carp.

Without entering more into details I will give the names of the three species of fish.

. First: California Salmon.

Its technical name is *Salmo quinnat*, and it is called the California salmon because it is very abundant in the rivers of California. Its form is elongate, its sides silvery white, the back greenish gray or blueish and spotted with numerous brown spots; the head is large, mouth wide, caudal fin deeply forked and pointed at the extremities. It has no red spots on the side like the trout. Its size is large, individuals weighing twenty kilograms having been taken. Its flesh is extremely delicate, of a yellowish apricot color, sometimes deeply pink. It spawns in October.

Second: The Rainbow Trout, *Salmo irideus*.

This is also from California. In general form it resembles the common trout *(Salmo fario)*. It sides are yellowish white, the back brown, marked with elongated spots descending very low on the body; the caudal fin is truncate, but the fish is especially distinguished by a beautiful rose band, which extends along the sides from the opercle to the caudal fin. The opercle itself is strongly tinged with pink. The rainbow trout does not reach the proportions of the California salmon. It does not exceed fifty to sixty centimeters (twenty to twenty-four inches); its flesh is sometimes white with a tinge of yellow, sometimes pink, according to surroundings, less delicate than that of the California salmon. It spawns in April.

Third: The Brook Trout, or *Salmo fontinalis.*

Its form resembles that of the trout; it is a very pretty fish. Its fins are margined with white, which, with its dark sides, spotted with white, give it a striking resemblance to the *ombre-chevalier.* Like the rainbow trout it does not reach a great size.

These three kinds of fish have been made the subject of many experiments in the Trocadéro Aquarium. I have studied their habits, their characteristics, in order to appreciate their qualities and their advantages, and have endeavored to learn thoroughly their reproduction and rearing.

The qualities which radically distinguish these species from our native Salmonidæ are important.

First, their growth is more rapid. It is possible in ten months to bring them to a weight of three hundred grams. At three years they may measure twenty-eight to thirty-two inches and weigh from thirteen to fifteen pounds. They do not offer any difficulties on account of purity of the water, and accept surroundings to which our trout would not submit. They endure high temperature; they will live in roily water of a temperature of 25° centigrade, while the trout succumbs at 18°. Finally, these salmon, in spite of their name of salmon, are not obliged to go to sea to prepare for their reproduction. They can live and reproduce in fresh water. So, although zöölogically they are salmon, from the culinary standpoint they are trout.

It is true that in California *Salmo quinnat* descends the Sacramento, but this journey is not obligatory. In the tanks of the Trocadéro the quinnat reproduces wonderfully, and after five generations its spawning is today as ample as at the beginning.

In studying their qualities I have observed among these three species certain differences, which caused me to become attached especially to the California salmon. Its flesh is very superior in quality, as has been remarked by certain authors, to that of the rainbow trout, and this is an important thing to be taken into consideration in its acclimatization. In order to make the comparison it is necessary to eat fish of the same age, raised under the same conditions, and at liberty.

It will be seen then that the rainbow trout is far from having the same delicacy as the California salmon. Its flesh is a little hard and dry, resembling that of the white fish, while the quinnat has fine, tender, and creamy flesh like the Scotch trout or the very young salmon.

The California salmon has another advantage over its two congeners—its reproductive period is very advanced. It spawns in the second half of October, while the brook trout spawns in December, and the rainbow not until April. This peculiarity is of the highest importance; it is that upon which is based my preference for the California salmon in the method of culture which we are to explain.

In the enumeration of these qualities there has been less question about the brook trout than the other two species. This is because the fish has not the same adaptability to artificial culture; it is more capricious in its habits; it is oftener subject to inexplicable mortality, and on these accounts I have relegated it to the third place, at least for the present. In that which follows I will confine myself to the California salmon.

In the first place we must ask ourselves the question whether the California salmon is susceptible of culture in ponds. On this subject I have made numerous experiments, which have furnished precise and conclusive results, and which prove that it lives very well in ponds, thriving in them remarkably well.

Without fatiguing you with all these experiments, I will cite two which were undertaken in a small and a large pond.

Dr. Léon Lefort, Vice-President of the Society of Acclimatization of Paris, has raised California salmon and rainbow trout in a pond of a hectare and a half in Sologne. The alevins were furnished by the Trocadéro Aquarium. They were about eight centimeters long when they were placed in this pond of comparatively high temperature. After two years' sojourn in the pond the fish reached an average size of twenty-four inches.

With the assistance of the Fishery Society of Langres (Haute-Marne) I made a rearing experiment in the pond of Leiz, situated near that town. This is a body of water covering two hundred hectares and has no streams flowing into it. We were therefore assured that no predaceous fish would destroy the alevins which we placed there. Under these conditions before the third year the California salmon reached a weight of six to seven kilograms and a length of thirty-one inches, and some of them reproduced.

It is therefore shown by our experiments that the American Salmonidæ live very well in a pond and grow rapidly. Let us inquire before leaving this subject how it is possible to rear these fishes as regularly as carp are raised. In taking carp culture as a type we do not expect the same results, and it is partly by having misunderstood this principle that the attempts made with trout have been unsuccessful.

Fish culture should be a methodical process, producing returns with certainty and regularity. Carp culture has for its object the bringing of this fish to a size advantageous for market purposes, but the carp is not marketable until it reaches a minimum weight of one kilogram, and it finds a better sale when it reaches a weight of two, three, or four kilograms. If we wish to keep them long enough in a pond to attain this weight and the best perfection possible, we must arrange the ponds in such a way as to secure this as rapidly as possible.

The case is by no means the same either with trout or California salmon. These fish are marketable when they have attained the weight of two hundred grams, and it is to be observed that they bring a better return at this weight than those weighing two, three, four, or more kilograms. As a matter of fact in the Paris market the large trout bring eight francs, while the small ones of two hundred grams are sold at ten francs.

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But a carp weighing two hundred grams is not edible. It is precisely this difference between the California salmon and the carp which serves as a basis for organizing the new method of culture, which I have the honor to explain. We seek merely to obtain small Salmonidæ, and this permits us to secure an annual return, a thing which the carp rarely furnishes.

Doubtless this difference in the method of culture will incommode not a little the fish culturist who is in the habit of raising carp. But pond culture of the California salmon as I shall explain it is very simple.

As in all intensive culture this requires care, frequently greater care than with the carp; but we shall see that it yields nearly ten times as much as carp culture.

We will now for greater clearness inquire successively into the different conditions which may present themselves in pond culture.

Suppose, in the first place, a property contains many ponds, some with warm water, others with cold water, a condition of frequent occurrence, how shall these ponds be arranged for use in the culture of the Salmonidæ?

The principal prerequisite for a pond culturist should be to insure abundant nourishment for the fish. In the culture of the carp, which is herbivorous, the ponds must be well supplied with certain species of aquatic plants. I have insisted so strongly upon this point in my recommendations for the last ten years that many proprietors of ponds begin to recognize its value.

At present we seek to raise carnivorous fishes, and all our efforts should lead primarily towards securing an abundant supply of animal food. Certain specialists have believed that they could solve this problem by an unlimited supply of crustaceans; this is the system of Lugrin. I have demonstrated in experiments made at the Trocadéro Aquarium that feeding by means of daphnia is simply a dangerous illusion. These little animals possess very small value as food, and fish which are subjected to this regime do not grow. But it is important to the fish culturist that his products grow as quickly as possible, and to accomplish this we must not forsake food materials of rich quality, like meat, blood, etc.

We employ the two series of ponds, of warm water and cold water, for different purposes. The warm ponds in which fish reproduce and grow rapidly, because plants grow in them, are used to raise herbivorous fish of rapid growth, like the carp, tench, and roach.

In this new method of culture the carp and its rearing does not entirely disappear. It is simply relegated to the second place, and cultivated, not for the purpose of obtaining fish of marketable size, but for the fry, which are intended for feeding the Salmonidæ. Carp, roach, and tench, hardy fishes of which the multiplication is unlimited and the growth rapid, will be grown in warm ponds, but produced in such a manner as to remain small, and in order to obtain this result we allow the breeding ponds to be overstocked with eggs, a thing which was avoided carefully under the old methods, but which on the contrary we seek to attain, because we desire nothing but to produce fry smaller than the carnivorous fish which are to feed upon them.

Besides, the American Salmonidæ, and particularly the California salmon, develop much more rapidly and much earlier than the fry of the Cyprinidæ. In August the young carp measure scarcely four centimetres, and at the same time the California salmon are ten centimetres long at least if they have been properly raised. Thus, the new method of culture is based upon the abundant production of minnows with a view to their transformation into flesh of the Salmonidæ, and in the two series of ponds we conduct two methods of rearing, each of which is equally important. It is clear that each type of pond will be differently managed. The warm ponds should have the banks sloping, should be shallow and well exposed to the sun. The bottom should be furnished with an abundance of plants of suitable height.

The choice of these plants should not be left to chance, but made with judgment, according to the different species of fish which are to inhabit the ponds. As these aquatic plants are not well known to fish culturists, I will mention those which are useful for ponds intended for the cultivation of carp, tench, and roach.

At the end of February or the beginning of March the breeding fish are placed in the pond according to custom, but in double the usual number, in order to insure a surplus production of fry, the securing of a very great quantity of eggs here being the sole object of the operation.

Spawning will take place at the end of May, and the pond will contain a considerable number of alevins, which will be three or four centimetres long, in August. It will be easy to catch them with fine seines and to transport them quickly to the cold ponds devoted to the rearing of Salmonidæ.

The fish culturist must proportion the number of young of the Cyprinidæ which he will need to the number of Salmonidæ which he desires to feed, and experience will quickly teach him this proportion, which will of course vary with the surrounding conditions and the additional nourishment, more or less, which can be obtained from the worms and insect larvæ in the pond; besides, if there should be a surplus of food for the Salmonidæ he can easily sell it to other fish culturists.

As a general rule, the young carp and tench will be eaten up before they have reached the length of eight centimetres. No advantage is to be derived from allowing them to grow larger. Every year the fish culturist will then secure a new production of fry. There is nothing in this which is either complicated or calculated to embarrass the fish breeder.

Let us proceed now to the arrangement of the cold ponds (I repeat that by cold ponds I mean ponds in which the water is not more than 16° centigrade). Nevertheless, since we have to do here with California salmon, we may consider as cold ponds those in which the temperature rises to 24° centigrade during the heat of summer, that is to say, a truly cold pond of the ordinary kind for Salmonidæ is not a necessity in this method of culture, which has succeeded marvelously in regions provided almost entirely with warm ponds, as at Sologne.

Since a locality always contains some ponds which are cooler than others, I recommend to the fish culturist to give the cooler ones the preference in rearing the California salmon. There are a number of reasons for this which I will not enter into here.

It will be well to arrange beside these ponds one or two moderately large elongate basins, in which the water can be circulated. These basins are intended for the rearing of the salmon alevins, and in this way time may be saved, because the young increase much more rapidly in them than if they were at liberty in a pond. The rearing basins, dug in the soil, should have a depth of at least half a metre to one and one fifth metres, and the banks should be sloping. A width of a metre and a half will be very practicable. They need not be fully stocked with aquatic plants; a few clumps may be placed in them, which can be arranged in pots buried in the gravelly bottom. The plants which should have the preference are the large-leafed Potamogetons and the Menuphars; at first they will serve to oxygenate the water and later to furnish shade for the young.

The breeder may have recourse either to eggs or to alevins; the latter are always high priced and difficult to transport. It is, therefore, much more practical to procure the eggs, and, from another point of view, it almost always happens that alevins which are purchased have been injured and have not been properly fed. It is well to know that in this case the inevitable result will be an arrest of development. They will not become large, no matter how favorable the conditions in which they are placed.

Preference should be given to eggs, which involves a slight complication, it is true, because it will be necessary to hatch them; but nothing is easier, and we have today hatching apparatus so simple and practical that hatching is merely a pleasure.

The price of fertilized eggs of California salmon is about eighteen to twenty francs a thousand.

After hatching, the fry are transported to the rearing basin, and at the end of about fifteen days, without waiting for the complete absorption of the yolk sack—I insist especially upon this point—the feeding should be commenced. The food should be suspended daily in the water by means of a zinc vessel placed about twenty centimetres from the bottom. The general principles of rearing fry should be followed rigorously. In feeding them one should not seek for variations or for imaginary improvements. It should be our aim to grow the alevins rapidly and give them the richest and most easily assimilated food.

For more than ten years I have employed for this purpose the spleen of beef, calf, or horse, the price of which is low and its preparation very simple, because it is given raw and its nutritive properties are very great. This substance has been employed for food of the youngest salmon at the Aquarium of the Trocadéro almost exclusively since 1883, and many fish culturists have followed our example. Blood is also an excellent and cheap food. It should be slightly cooked in hot water. One may ignore all other forms of nourishment, particularly daphnia and the prepared foods which are so extensively advertised.

What number of alevins can be reared per hectare? Experience has shown me that if the conditions are favorable one may raise without danger in a hectare of water, with an average depth of one and one half metres, two hundred kilograms of Salmonidæ at least. If, then, the fish culturist follows my advice by raising California salmon to the weight of two hundred grams, he will place one thousand alevins in a hectare. If he desires to raise fish of a larger size he must use fewer per hectare. Here are, in this respect, the approximate numbers:

1000	salmon of	200	grams	per hectare.
500	"	400	"	" "
200	"	1	kilogram	" "
125	"	1½	"	" "

These numbers are the results of numerous experiments which I have made upon this point, and I have taken pains to give the minimum, which may often be surpassed under favorable conditions.

At what time should we place the alevins in the pond, and in what time may we expect them to reach marketable size?

The spawning of the California salmon takes place very early, and on account of this precocity it is chosen as the basis for pond culture. With it we are able to complete the culture in one year, a very great advantage which one cannot realize either with the common trout or the rainbow trout, because the former grows very slowly and the latter does not spawn until April. The eggs of the California salmon, deposited at the end of October, hatch in the middle of December. If they are placed at this time in the rearing basin and properly fed, they will measure on an average twelve centimetres by the middle of July, and will then be very suitable for liberating in the pond.

If the temperature of the year has been very high, and the spawning of the carp takes place early, we may doubtless place the salmon in the pond earlier.

By all means the young salmon should be placed in the pond not later than in August. At this time a great many of the Cyprinidæ will be sufficiently developed to answer for their food. The fish culturist then proceeds to seine the alevins with a fine net and to place the salmon in the pond which has been well furnished with its food.

The breeder from this moment should exercise a continual supervision over the pond and assure himself that there is constantly an excess of small fish, for it is essential, in order that the salmon may grow rapidly, that they should find a superabundance of nourishment. Besides, one should be careful not to place too many in the pond at a time and thus cause difficulty.

These young Cyprinidæ do not find favorable conditions for their existence in the salmon pond and will become sickly and furnish indifferent food for the young salmon.

Beginning from the commencement of August, in what time may we hope that the salmon will attain to the weight of two hundred grams? Herein the superiority of the California salmon over other fishes is demonstrated. I do not know any other of which the growth is so rapid when placed under favorable conditions. It does not require more than six months for a young salmon of twelve centimetres, placed in a pond at the end of July, to acquire the weight of half a pound. One may obtain even better results by placing these fish under certain conditions, but this is about the average with current methods. We may, therefore, at the end of January market our salmon.

It will be seen that pond culture by the method which I have indicated can be made to give a very gratifying annual return.

If the breeder desires to obtain larger salmon, instead of catching them at the end of January he should continue the rearing in the same manner, and at the end of the second year he will obtain salmon measuring forty-five to fifty centimetres. I need not add that if one cultivates fish of greater weight than two hundred grams, the number per hectare ought to be reduced in proportion to their size. Upon this subject I refer to a table which I have given above.

As far as my experience permits me to judge, the breeder should limit himself to the average weight of two hundred kilograms per hectare under ordinary conditions. I have reference to a hectare of standing water, for if the pond is traversed by a sufficiently rapid current, such as would be furnished by abundant springs, it is evident that this proportion may be increased. I, therefore, give the amount of two hundred kilograms as a good average, rather low, but it may serve as a rule in the majority of cases. If one exceeds this amount very much, he will experience disastrous results, which should be avoided at all cost.

DISCUSSION ON THE PAPER OF DR. TARLETON H. BEAN.

Mr. Cheney: The reference to daphnia as fish food in Dr. Bean's translation seems to be in direct contradiction to the experience of the late Mr. Thos. Andrews, of England, and of Mr. Chas. G. Atkins in this country, in that Dr. Jousset de Bellesme condemns the little crustacean and Mr. Andrews and other fish breeders highly approve of it as food for fishes. This is explainable, perhaps, when it is understood that the French fish breeder desires to obtain quick results in rearing fish for market, while Mr. Andrews and Mr. Atkins commend the daphnia for very young fish, to be reared for breeding, and not for the table, and I think the daphnia should not be condemned as fish food simply because it is not food on which to rear fish to half a pound weight in a given time, for undoubtedly daphnia constitutes a large portion of the food of our young fishes in wild waters.

Dr. Bean: I ought not to take the floor any further, but I think I may not have made it perfectly clear that I have seen California salmon reared by Dr. Jousset de Bellesme—and I think probably there are others of our members who have seen them too—in the Trocadéro Aquarium, and even as early as July, when our own trout would be at the most three or four inches long, he had fish six inches long, and he raised them in the way he described. It appeared to me that I had never seen handsomer or bigger fish than he had in the Aquarium.

In that little place, where he has only four pools for all his experiments with salmon, he gets sixty thousand eggs of the California salmon every year, hatches them, and raises thirty thousand fry. The whole place is run at an expense of twenty-five hundred dollars a year.

Mr. H. Whitaker: It is a very difficult thing to discuss a paper of the scope of this paper on the spur of the moment, and it must be left for larger consideration until we have had time to read and digest it. There are some things which the writer states that are certainly antagonistic to the views that are commonly held. Not more than a year or two ago, a very skilled physician, Dr. Feurth, of Germany, settled in Detroit. A year or so after he came to Detroit to reside, he came and introduced himself as a gentleman who had been interested in fish culture abroad, and since that time I have found reason to know that he was a practical man in fish culture. I found also that he was familiar with the literature of this country regarding fisheries and fish culture. There was nothing, apparently, that had not been brought to his attention.

There is a remark in this paper that is entirely opposed to what Dr. Feurth told me with regard to the brown trout. His familiarity with the subject was such that I inquired of him what temperature of water they were best calculated to be put into. He assured me and urged me to have some put into our rivers in the extreme southern portion of the state, and he instanced one or two places in Germany where the brown trout had been introduced into water at a temperature of 70° in summer, and he said they thrived beyond all expectation. We have made the experiment this year, and yet the writer of the paper says they will not thrive in warm water. It makes no difference about the exact temperature; the writer intended to intimate that they were not calculated for warm waters, irrespective of exact degree.

Dr. Bean: This paper refers to California salmon.

Mr. H. Whitaker: I am speaking of the brown trout. If the remarks meant anything, it is that they are better adapted to cold than to warm waters. But this gentleman from Germany, who has lived there all his life and is well informed, assured me that the brown trout was doing exceedingly well in waters of 70° in summer; so there is a difference—of course doctors disagree.

There is a very interesting point in connection with this paper—the marvelous statement of this gentleman who says carp are to be despised, because they are so cheap. The price of carp here rivals the price of our better fish in our markets, and in some cases far exceeds it. Let me say a word for the much despised and much disparaged carp. Of all the varieties of foreign fish attempted to be put in American waters, I look upon the carp as one of the most successful and desirable. This may be the rankest heresy, but I tell you it is a fact, and the future is going to show that it will occupy a distinct place in our domestic economy. Its strongest feature will be as a food for the poorer people. I do not know, taking into consideration the prices current as given in the Fishing Gazette, but that it will be too high for the common people, because the wholesale prices reported in the Fishing Gazette, which I have had collated for more than two years, show a wholesale price, I think, a little over six cents a pound, and there are some other men to make a profit out of it still. It is an edible fish. A great mistake regarding carp in this country is that the general belief of the people has been that it is a rare fish, and that it is a rival of the trout or the white fish, or some other desirable fish. Nobody ever introduced it with that idea. I do not believe it, although it is highly esteemed with the food fish of Germany, surrounded by the glamor of the romance of the royal dish for the king; at the same time it is a good fish and must enter into our domestic economy.

One word with regard to the fry. In Michigan we have not attempted to introduce the carp into our Great system, and the result was that a year ago last fall a Frenchman was fishing at Point Mouille, on Lake Erie, and he "cot seventy-fiv de barl of carb" and did n't know what it was. To show the importance of that in our locality, I had our statistical agent take two days and go through our markets and make inquiry of the fish dealers as to what value the carp was, what magnitude the sales were, and the sales last year in the Detroit market were seventy tons, which is quite a considerable amount for a fish which introduced itself. Lake system, and have put it into very few rivers. But nature takes care of that thing. The fishermen are robbing our lakes of all the good fish, irrespective of size, and the question is, what is going to become of our waters, and in a measure the carp is solving the question for us. We have a great many applications for fish, as all commissions have. A man wants fish, and will take carp if he cannot get anything else, and some take it out of preference. He builds himself what he calls a pond, and the average farmer thinks he has exerted himself far enough if he throws up a bank of soil that will hold water in the dry season. Fortunately, the freshets of spring and summer time come along, and they wash out his pond as a matter of course. The result is that the connecting stream is stocked with carp, that stream enters into the Lake

But above and beyond all that, he must occupy another position, and in that respect I agree with the writer of the paper. I was talking the matter over with Dr. Bean yesterday. It is going to be the food, or should be the food, of our better varieties of fish, as suggested here. They are prolific and the young are an edible fish, and you simply convert the carp into a better fish, so that you have the carp as a valuable factor there.

There is one more remark I want to make in connection with this paper. You will observe that he suggests the planting of fish before they lose their sac, which I entirely agree with, and which I have reason to believe is a good thing. For the last two years we have been planting our trout before the sac has been fully absorbed. The result is that you get a good, strong, healthy fish, and when he swims out he is able to take his natural food. To discover when fish begin to feed, we have instituted some experiments in regard to white fish. We have taken them as soon as hatched and put them into receptacles, so arranged as to permit the free ingress of water with the natural food it carries, and we then made examinations under the microscope of the contents of the stomach of these fish. On the third day our commission was engaged, and we did not give the matter attention, but at the end of the fourth day they found that some of the young fish were taking the daphnia and that sort of thing from the water. At the end of the sixth day they found that food in the stomach of every one, and the sac was not yet absorbed. This was with white fish.

Mr. Cheney: How about trout?

Mr. Whitaker: We never tried it with trout.

Mr. Cheney: Would you plant the trout before the sac is absorbed?

Mr. Whitaker: We do, and have done for the last two years. The result is that in taking fish out at that age we have lost almost nothing in transportation. We believe, beyond all doubt, that it is a good thing. There are some other points in connection with the paper that come to mind, but I will not occupy the time of the meeting any further. I think the thanks of the Society are due to Dr. Bean for submitting the translation of this paper to us, and when we have opportunity to look it over we shall be glad to do so.

Mr. Titcomb: One subject that has been referred to by Mr. Whitaker has somewhat shattered my hopes. Up to this year it has been the custom of the fish commission in our state to plant the fry before the sac was quite absorbed. The result was that we had to plant them before the conditions were right. This year we hatched our fry in spring water. They were all hatched in April, and fed in April, up to the last of April. At that time our streams were full of floods and the snow was not out of them until the first of May, and the result was that we fed our fry a month before planting them, and, in fact, we have not planted them all yet. We have been distributing the last two weeks, and in every instance where we put them out the applicants have been very enthusiastic about the condition in which the fry have been received, and we have greater hopes of the future results of these plans than in cases where we planted previously with the sac nearly absorbed, and before the streams were in proper condition to receive them. I have come to the conclusion that the time to plant them is after the sac is absorbed.

Dr. James: I think this Society ought to feel thankful if an experiment of this kind has been made to succeed, even if it goes a little in opposition to the ordinarily accepted views and experiments of former observers. It seems to me that it is a very long step in the direction of furnishing a better food to the people at a more moderate rate, comparing the amount of actual nutrition which is obtained in the same length of time, say two or three years, so that looking forward from the standpoint which I take in this matter in the way of protecting the fish, in order that a greater amount of value may be obtained from it for the people, I think it is a valuable experiment, and I am glad to see it has so well succeeded.

With regard to the carp, I want to say that the thing Mr. Whitaker spoke of occurred to me some years ago, when I owned a farm with two or three ponds upon it. I obtained the carp from the United

States Fisheries, at their propagating grounds at Washington, and planted them, and on both occasions through the heavy rains, notwithstanding that I took, as I thought, ample precautions, I lost all my carp after they had pretty well grown; and in the large stream right near there, about half a mile below where my ponds were, connected by a stream, two years after that they were finding an abundance of carp, and the boys around the neighborhood were much rejoiced to catch large carp in the main stream. I think some of my neighbors, likewise, lost their fish in the same way; so that I think we were instrumental in quite largely populating the Vancouver stream, on which my farm was located, and in the surplus water of which we undertook to propagate fish, was pretty well filled with the carp.

INTER-STATE PROTECTION OF FOOD FISHES.

BY DR. BUSHROD W. JAMES—PHILADELPHIA FISH PROTECTIVE ASSOCIATION.

Some years ago the subject of the United States Government exercising a certain fish protecting control, or at least supervision over the rivers which run through two or more states, and which are frequented by shad, herring, salmon, trout, bass, and other species of food fishes, was presented before this American Fisheries, or Fish Protective Society, by the late United States Fish Commissioner Marshall MacDonald, and it was ably defended by some members of this Society, the United States Fish Commission, I think, generally supporting it; but the majority of opinion outside seemed, at that time, to be unfavorable to the measure.

The proposition was made for the purpose of securing protection to the fish along the coast and also when they are in the act of passing across the state lines in order to enter their spawning grounds in the upper rivers and their tributaries. Each part of the discussion was clearly in favor either of United States supervision or of state supremacy, but decisions by the Supreme Court of the United States have been made that the measure would be unconstitutional, so that each state maintains its exclusive right over its fishing streams, except in a few instances, such as the states of

Pennsylvania, New York, and New Jersey, where these states have entered into an inter-state protective agreement, which still remains imperfect, however, until Delaware joins in the compact. This agreement specially relates to the shad, which, running up on our eastern coast, and into their habitat rivers and streams, attain the perfection of flavor and superiority of quality in the waters of the Delaware River. For many miles the four states herein mentioned have exclusive rights to this desirable fish, and it having been proven that non-protection would finally result in extermination, the wisdom of inter-state legislation was acknowledged and joint-protection laws adopted. Delaware doubtless holds the law under protracted consideration because of the vast numbers of fish that have annually fallen into her nets, but when she becomes satisfied that the proposed legislation will actually produce better effects for the fisheries of her own domain, as well as that of her sister states, she will, I have no doubt, accept the proposed legislation without further demur.

It stands to reason that if a co-operative law guards the fish during the spawning season, the number will increase in surprising ratio.

Another thing to be considered is the unpalatableness of fishes that are hurrying into shallow waters in order to deposit their ora. The flesh is soft and somewhat flavorless, and of late years particularly the roe alone of spawning shad is regarded as valuable. In some of our markets the body of the fish can be purchased for a small sum in comparison to the price paid for the crisp, bright flesh of the male, while the roes bring fancy prices according to the wealth of the purchasers.

I must confess to an idea that a single debate is not sufficient in such a matter, but that we should urge it from time to time, until all the individual states thus interested arrive at some suitable inter-state legislation, that will produce lasting benefit to all concerned.

We would refer in this connection to the acknowledged benefit accruing from the fish hatcheries that have deposited several varieties of young fish in the upper streams of many of our important rivers. If artificially hatched fry produce such commendable results, is it not easy to understand how protection of the breeding fishes and their young must necessarily amount to still greater good, because of the very much larger number that would be produced through the natural course of fish spawning, increased production meaning increased revenue?

We must consider that it is the bounden duty of the states to provide in every possible honorable manner for the increase of every industry within the limits of their jurisdiction, and that the supplying of food fish is and always has been a very prominent industry in our coast and lake bordering states particularly. We have had it demonstrated to our perfect conviction that indiscriminate fishing with the numerous devices of modern invention has very nearly ruined the food fishing interests in certain waters, and that whole towns and bays have been nearly impoverished by the lack of supply for home consumption, as well as for trade.

We have also had very satisfactory demonstration of the astonishing benefit already derived by the protective systems recently adopted by several states, especially in reference to the Delaware River. Therefore, we cannot but express the firm conviction that the governments of the respective states should act in such a manner as to make mutual state laws to suit the various localities, not taking the laws of Pennsylvania, New York, and New Jersey as the text, but let the legislation for each part of the country be consistent with the requisites of each. New York and Pennsylvania may well be satisfied with the outcome of their legislation thus far, and the example of each might well serve as a beacon for all other states. But year after year passes and border waters still remain unguarded to a very great extent.

Maryland is now making efforts through her State Fish Protective Association and her commissioners to join with Pennsylvania in protecting the Susquehanna and its great tributary branches. They have already succeeded in exterminating all authorized means for fishing in this great river which runs through Maryland territory, where the objectionable pounds and wiers once almost depopulated the upper waters of this valuable fish, the shad, just as it was aiming to reach the breeding places along the upper branches of the Susquehanna.

The Potomac is yet but partially guarded. Maryland has passed a law, which applies to the Potomac and its tributary rivers, forbidding fishing from April 15th to June 1st, but it has thus far only received the co-operation of Virginia, and the law cannot be properly enforced until West Virginia laws concur in the project. Thus two inter-state laws are held somewhat inoperative, each because of the non-concurrence of one single state for each in a compact which would in reality receive equal advantage if they would but study the matter with unbiased consideration. Delaware evidently holds back because she has the opportunity of access to the large schools of fish as they turn with unwavering instinct toward the calm, pure, shallow waters of the upper Delaware River and its communicating streams in Southern New York and Northern Pennsylvania. But can the state of Delaware claim the same commercial value for the fish as she takes them, and the same fish as taken in the upper stream under the protective laws of the three adjoining states? I think prices will and must speak; and this very season we have some proof. Before the legalized season in Pennsylvania it was possible to buy large roe shad for from twenty-five to thirty-five cents, while the males sold for much less. Some of the fish were quite satisfactory, but most were soft, devoid of their usual rich flavor, and objectionable, though undoubtedly fresh. Then came a week or two when right fresh shad could not be had in any quantity, and then came the "real fine Delaware shad," no larger than the former, but possessing the true, rich flavor peculiar to the perfect up-river fish with its firm white flesh, and these were entirely unattainable in the market at retail under forty-five or fifty cents for the smaller, while the choice specimens ran up to a higher price. Now, if the more southern states were content to legislate with the northern, and permit the spawning fish to ascend the streams unmolested on certain days of each week, the shad season would not begin so early in the year, but the catch would be more valuable in the end. We think it would be wise to teach those who are interested in the fisheries that when a roe shad is large and flabby and the eggs quite large and distinct from one another, that the flesh thereof is really quite unfit for good food, and that in selfishly taking the roe, the increase of the number of fishes by spawning for the next season is lessened by many thousands, for each large roe fish that is caught and eaten diminishes the spawn supply accordingly, when indiscriminate fishing is permitted. Another thing that is to be taught is that all roe fishes that ascend with the schools in the running season do not deposit eggs, and therefore it does not preclude the possibility of obtaining the desirable dainty fish to wait until the spawning fishes have gone to their haunts. When these questions are fully understood, Delaware and West Virginia, as well as all the other states, will doubtless see the plausibility, in fact, the necessity for this inter-state legislation.

But while states in juxtaposition may be prevailed upon to pass joint laws, it cannot be looked upon as a certainty that they will always maintain them, when it is found that the interests of one state comes into apparent opposition to those of its neighbors which border on the same waters. Hence, is seen the proof of the positive requirement of good conjoint laws. They must not be too restrictive upon one territory, not be too lenient with another, and yet they must be of such a nature as to be the means of adding many hundreds of thousands of dollars of increased revenue, to each state interested, to the already present value of the food fish industry.

Another view to take of this very important subject is the probability that when the people of these states are more enlightened upon the subject, and take the matter into practical consideration, each state will be willing to co-operate, knowing that self-interest alone cannot make the best laws for all. This subject must naturally arouse some doubt in the minds of legislators of neighboring states, when each state is allowed to legislate only in its own way upon that which is truly a mutual affair.

The dissatisfaction that will surely exhibit itself in making inter-state laws, at first, will soon melt away before the proofs of the success of such agreements.

The increased number and value of the food fishes which have been hatched in the different authorized fish hatcheries through the country, the fry from which have been deposited in rivers in many parts of different states, show the value of the plan too plainly to ever allow it to fall into disuse, but when the spawning fish are so protected that they also will produce more largely, the industry will once more become peculiarly lucrative, not only to individuals, but to states and the country.

Wealth always begets wealth if properly directed, and our state governments are not so rich as to be indifferent to augmenting their revenues. Therefore, let us still keep it before the eyes of the proper authorities that state legislation positively requires conjoint laws to improve the present situation.

DISCUSSION ON THE PAPER OF DR. JAMES.

Mr. Amsden: Any remarks on this paper just read by the gentleman from Pennsylvania must call to mind one thing. There is almost due, if not past due, a report from the joint commission appointed by the United States and Great Britain, of which Mr. Rathbourne was one, which commission was to look up this subject of the depletion of the Great Lakes, the cause, and make such recommendations for the future as were deemed wise. I have been looking many months for that report. I think it is now in the hands of the printer. That covers the same ground as the paper just read—this interesting matter of protection. I do not believe that we will ever get any national legislation on this fish question, on account of the jealousy between the states and the state right question. It seems to me that this Association might be of great service in that direction, and do something more than meet once a year, and the thought occurred to me while the paper was being read why this Association could not authorize its President during the next year to take this subject up and go before the Legislatures of the states that stand out, like Delaware and West Virginia, and let him appear before them, and in argument bring them around in line with the other states. The same condition exists on the Great Lakes. There the states do not act in unison, and never have. Then the question of jurisdiction comes up that the states cannot act to form any treaty act between themselves and the Dominion of Canada; it is only the United States that can join in any treaty, so that it makes it a difficult question to solve. That thought occurred to me, why this Society cannot be of some benefit in bringing about joint state action, not only on the rivers, but the Great Lakes.

Mr. Mather: The suggestion that Mr. Amsden makes, that the President of this Association do that, is a good one; but just exactly how the President of the Association shall do it, or where his funds are going to come from, I do not understand.

Mr. H. Whitaker: His expenses to be paid from his salary as President.

Mr. Mather: This Association certainly cannot bear the expense of it, unless the President does it out of his salary as President. (Laughter.)

Mr. Dickerson: I do not believe it is practicable to change the Constitutions of the several states so that the laws could be uniform, as suggested. I think that would be impossible to bring about. It occurs to me that the only way to do it is to go a little further than the gentleman has suggested, and that is, appoint a committee—I speak now of the lakes bordering on fresh water, the salt water lakes we have nothing to do with—but we need a uniform law for the protection of game and fish in all states bordering on fresh water lakes, and it seems to me the only way to do that is to appoint a committee of three or five, which shall draft a bill, which shall be uniform in all states bordering on the Great Lakes, and then let the fish commissioners of the various states see that the bill is introduced, and if possible put through their Legislature. In our Legislature last year, if there was one, there were a dozen or more members said to me, "When you can get Ohio, New York, and Pennsylvania to join in a bill that shall be the same as ours, that shall be uniform on all the Great Lakes, then we shall unite in anything the Commission of Michigan may suggest." I also have assurances from the authorities in Canada that in any bill we may agree upon they will meet us half way; and it seems to me that the only feasible way to do this is to appoint a committee to draft a bill, and have it uniform in all states, and put it through the various state Legislatures to which they belong.

Mr. H. Whitaker: The suggestion contained in the paper of Dr. James is a very familiar one. There is no doubt that it does not lie in the authority of the United States to enforce any law to preserve the fisheries interest. The thing has been re-affirmed by the United States Courts, and no later than sixty days ago, that the police power of regulating these things lies in the state authorities. We have got to forsake this idea of appealing to the General Government for a redress of our grievances. When we attempt it we admit the weakness of the state to enforce its police regulation. The states have power, they do not lack power, but the difficulty in their way is the same that the United States would have to confront if they sought to have a law established, if it were possible, and that is the invested interest of money and means in the fisheries. The United States do not begin to be as able to cope with that sort of a question as the men who reside in the different states.

The thing that will bring about better results than anything else is a conference between the states interested in the matter and an agreement upon a uniform law to be passed, and for each state not only to bind itself that it will submit such a law to its Legislature, but that it will insist on its passage and enforcement. There is no question in the world that the fisheries of the Great Lake System, with which I am more familiar than any other, are bound to be exterminated within the course of a very few years. I was called up on the telephone by a wholesale fish dealer, from his house in

Detroit, within the last month. I asked him what he wanted. He said, "Come down here, I want to show you a barrel of fish. It is a d—— shame. We have fish here of your planting, and a dozen of them will not give a half-pound."

Mr. Amsden: Where were those fish taken?

Mr. Whitaker: At Grand Haven. They would not average a half-pound to each white fish. There were from two thousand to twenty-five hundred white fish in a barrel. There were some heavy (?), and if not heavy (?) were too small to be caught. I told the dealer I would like to have his bill and letter. He said I could have them both, and he gave them to me. Unfortunately, in our state, the administration of the fishery laws does not reside in the commission, but is given to a separate bureau. Fortunately, however, we have an active and efficient wardman there just now, and after bringing this matter to his attention, and in view of the fact that we have had eight years of wardmanship there, and there had never been an enforcement of the fisheries laws, he has taken steps to have this matter investigated. The man said, in his letter, that he could furnish a thousand pounds of fish a day of this kind, and as two dealers were supplying them there was sixty to seventy thousand pounds of white fish a month, not within two years of the spawning age.

Mr. Amsden: What is the violation of law for which the nets may be taken up?

Mr. Whitaker: The only law we have in Michigan waters protecting white fish is a regulation we had passed eight years ago regulating the size of the mesh. We have nothing regulating the size of the fish.

Mr. Amsden: What were the sizes of the nets?

Mr. Whitaker: The nets were seized because the lowest size we permit is two and one half inch mesh, and these were two and one fourth inches. As soon as these men were arrested, the Associated Press dispatches said there was to be a riot in the city. The business of these men was being ruined. What was their business? To violate the law. The dispatches said their business was being ruined and hundreds of families thrown out of means of support. Within forty-eight hours from that time—they did not have any riot, but the men were arrested all right—the nets were seized, not confiscated. Within forty-eight hours I received a communication from the committing magistrate and every Democrat and Republican of prominence in the locality, thinking they would have some influence with the Board, asking us to give these men permission to fish with their nets until the end of the year, and they would be good and not violate the law again, and would inform on their neighbors. I knew that we had no authority to grant this request, and with a knowledge of the history of the thing, as we understood it, we would not have granted it if we had. I called the Board together by telegraph, so that these men might not say that their petition had not received careful attention. We informed them that there was no provision in the statute in the State of Michigan that we knew of giving the fish commission power to waive the force and effect of the statute. Their next application was to the game warden for the same thing. After consultation with us, he gave them the same answer. On Friday of that week the Governor of the state happened to be in town, and I was informed that the fishermen went to him with their friends to make a personal application to the Governor. The Governor asked Mr. Dickerson and myself, who are the resident members, to come in and consult with him, and we did so. The Governor has a backbone like a crowbar. He treated the matter with civility and heard these men, and in their petition to us that they stated that they were not to blame for those imaginary Associated Press dispatches, and that the American Net and Twine Company representative induced them to have nets made of that size, and that they were not to blame. In the meeting at the Russell House, where the Governor was present, these men openly and frankly admitted that they did order these nets of the size they were fishing with, and the representative of another net and twine company said that he had informed some of those identical men that they were fishing with nets whose meshes were of an illegal size.

That is the sort of thing we have to run up against in Michigan, and I say to you that Grand Haven is not a single instance. They are doing it all over the state, and the returns we get from our statistical agent last year show that nearly two thirds of the fish caught in Michigan waters are No. 2, which never get to a spawning age.

It will be remembered that a year ago I suggested that authority be given to have a meeting called of the representatives of the Lake States, and it ought to be enlarged to take in all other states, because a question of uniformity in one direction is just as important in another. I think that meeting would have been called last year, but there are several Lake States which have biennial sessions of the Legislature, and which do not meet until the first of January, 1897. If it is possible to do so, a meeting of that kind will undoubtedly be called somewhere on the Great Lake system for consultation this fall, and see if we cannot come to some agreement that will, at least on the Great Lakes, give us a uniform law. We cannot admit the weakness of the state in this thing, because the state must be able to enforce its laws in one direction equally as well as the other. You have got to meet invested capital every time, and it is a hard thing to fight. It is not the disposition of a single fish commission to injure a man's business, but his business may not come within the law; and moreover, the act that the fisherman exercises is a privilege and not a right. The fisheries are the fisheries of the people, and whatever tends to injure the interest of the people in these fisheries, and which may lead to their extermination, must be resisted by the American Fisheries Society. The statistical agent of our state told me he went into a fish dealer's house on Mackinaw Island, and kicked open a keg of white fish, which contained fish of a size to require eight to make a pound, two ounces apiece. What do you think of that? Murder in the first degree. These fishermen are standing in their own light when they do anything like that. The fish which the dealer brought to my attention in Detroit, he said he got a half-cent a pound for. I asked him how much he would get if they were left in the water for two years, and he said six cents a pound. There is the thing in a nutshell. The people are expecting too much when they expect the fisheries are going to be renewed or sustained when you permit the parent fish to be taken out, and not only that, but you take the little fellows out before they have come near having the disposition or ability to spawn; and these things are matters which it is in the province of this Society to take cognizance of and correct.

Mr. Douredoure: Can you form some idea of what it cost to put this fish in the water—how much per pound?

Mr. Whitaker: I cannot tell you what it cost per pound. I can tell you what it cost the state of Michigan for the two years that we figured up, two years ago. Our total cost of fry put in was something like twelve cents and a half per thousand. In two localities on the Great Lakes, at least, we have the statements of the fishermen that they are catching our fish. The dealer told me the other fish were not ours.

Those were in Lake Erie. There are certain characteristics of the Lake Erie fish which cause them to differ from Lake Michigan fish. They have a hump on their back, and can easily be told by a Lake Michigan fisherman. In the Detroit River a great number of fish have been put in the past year. The report shows that in the west end of Lake Erie they had better white fish last fall than for a number of years, and it only shows that they are beginning to feel the effects of the restrictions which we have placed upon the fishing.

Mr. Amsden: It seems to me if there is any one subject the Society can take up and discuss with great benefit to the country at large it is this, and for the Society to meet once a year and publish its transactions, with a limited circulation, does not accomplish what it should accomplish. We complain because our membership is not larger and more interest is not taken in the Society. I think if we took hold of a subject like this and acted on it forcibly, we would enlarge the membership of our Society and accomplish something. To my mind, the food fish is of very much more importance than the game fish, and as to the expense of doing this, which Mr. Mather questions, I am willing to pay a good deal larger dues, if necessary, so that it can be done. These transactions that we publish do not reach the quarters we desire them to reach, and it seems to me that when the Legislatures meet it would not be very expensive for our President and one or two of our members to go right there before the committees and argue the matter and convince them of these facts. It is the only way that I see in which you can do it.

Mr. Gunckel: A word with reference to Western Ohio, as to these small fish. Ohio is in the position which has been stated here. They will say, we cannot do anything either, unless Michigan and Pennsylvania will jointly do something. I was personally acquainted with some of the leading fish commissioners. When Major McKinley was Governor he came to Toledo and sent for me, and asked me whether I would go on the fish commission. I told him no, I would not. I will tell you why. The Ohio Legislature does not recognize the five fish commissioners. Last summer they appointed a committee to go to Toledo, to go to Vermilion, to go to Port Clinton and Sandusky, to examine the fisheries. They ignored the fish commission, they ignored men who are connected with the American Fisheries Society in the position I am for the protection of fish, and they went to these places and were banqueted by these commercial men who are interested financially in the subject—the committee was banqueted and taken care of and not permitted to see any one that represented a class of men whose interests in the fisheries were on a higher plane than financial considerations—and this class of men is backed by all the newspapers of the city of Toledo, and the committee went home and arranged matters to suit the commercial interests. Congressman Southard, from our district, has brought the matter up again, and says he is in communication with Governor Bushnell, and has his approval; and we want to follow this thing up closely, and we want to know whether a reorganization of the fish commission of Ohio will not do something. I have been corresponding with Mr. Southard, and told him that the Legislature should recognize the commission, or else throw the commission out and begin anew.

The resolution that was passed here a little while ago appointing a member of this Society from each state to take an interest in this thing and see that the fish commissioners are recognized, if I remember correctly, I think would do a great deal of good. The last two or three months I have taken a personal interest in the American Fisheries Society. I have all the papers in Toledo back of this Society, and I think we are a little bit slow in waiting one year before pushing this thing. Let us begin now and start the thing where it belongs and will do the most good. I may be wrong, but these are things I observe from the outside, and I know I can bring the entire press of Northwestern Ohio in favor of anything that this Society may recommend. I am a member of the Press Club in Toledo, and I come with authority from them that they stand ready to aid you all in their power. I met the editor of the Commercial just before I left, and he said to me, "Mr. Gunckel, this paper stands ready at any time to back up the American Fisheries Society in their efforts for the protection of fish."

My attention was called some time ago to several barrels of fish from Toledo, of pickerel, perch, and white fish, that they had to take back and dump into the bay for want of a market. They were too small to sell. The papers all had accounts shortly after that the shores were covered with dead fish, and it was this fish that had been dumped in the bay, because it was too small to sell in the market. Is the American Fisheries Society going to permit anything like that? Are not they smart enough to get around this business, and get hold of the thing, check it? I have been stirred up very much over this subject, at times, and we should make a stand and prosecute this work. You have the good will of Major McKinley, the good will and backing of Governor Bushnell, and with such men as Mr. Whitaker in Michigan, I don't see why we cannot push things and make it go.

Mr. H. Whitaker: I want to say a word right in line with the paper read by Dr. James, and that is on the question of government control. The greatest mistake that Ohio ever made in this world was when she relinquished her interest in the propagation of fish to others. She lost caste and standing in her own state, and I tell you nobody can watch the interests of a state so well as her own citizens. (Applause.) We came near falling into the same trap in Michigan, but we saw it in time to avert the disaster. The proposition plainly was this—let us take possession of your fisheries and we will take sixty per cent. and give you forty per cent. Why should not the state of Michigan have the hundred per cent.? It is a good deal like the arrangement of the planter with the negro. He said to the darkey, "I will give you so much land to work, I will furnish you the seed, and you shall do the work and have one third of the crop." In the fall the darkey came around and said, "I come to see you now about settling up." "What do you mean, you black cuss?" "The cotton crop is in, massa, and I thought I would come and settle up." "What do you mean?" "You know, massa, I was to get one third of the crop." "Why," he says, "You black rascal, we did n't raise but two thirds of a crop; your third was n't raised." (Laughter.) That is about the way the thing sums itself up.

CONCERNING THE WORK OF THE FISHERIES, GAME, AND FOREST COMMISSION OF THE STATE OF NEW YORK.

BY A. N. CHENEY, STATE FISH CULTURIST.

So far as the Fisheries, Game, and Forest Commission of New York is concerned, the request of Dr. Bean, Recording Secretary of this Society, for a report showing results of work accomplished during the past year, may be summarized as follows:

Applications were received from the people of the state for planting in public waters, for brook trout, 10,-864,200; brown trout, 1,380,600; rainbow trout, 155,-500; lake trout, 6,110,000; pike perch, 13,143,000; black bass, 1,136,075; white fish, 30,000,000; ciscoes, 34,000,000; frost fish, 2,000,000; total, 98,789,375.

To fill their applications, the state hatched and had for the spring distribution fry as follows: Brook trout, 4,315,000; brown trout, 900,000; rainbow trout, 100,-000; lake trout, 3,255,000; frost fish, 10,000,000; ciscoes, 32,000,000; white fish, 11,750,000; total, 62,-320,000.

In addition, 265,000 brook trout, 81,000 brown trout, 57,000 lake trout, 10,000 rainbow trout, 15,000 land-locked salmon, 3,000 sea trout from Europe, or a total of 431,000 fry, were retained at the hatchery stations to be reared to eight and twelve months of age before planting in wild waters.

The work of hatching and planting the spring spawning fishes is not yet completed, but it will be observed that of the various species of trout 18,510,000 fry were asked for, and only 8,560,000 were on hand to fill the applications. There was a shortage of 18,250,000 white fish, 2,000,000 of ciscoes, and a surplus of 8,000,000 of frost fish, which is the round white fish found in Adirondack waters. Among the fish not enumerated, 76,000,000 of tom cods and 35,000,000 smelts were hatched and planted in Long Island waters; 50,000 eggs of the Atlantic salmon were received from the United States Fish Commission, and the fry hatched and planted in the head waters of the Hudson River, and 302,000 lobsters in Long Island waters. 100,000 eggs of the steelhead trout were also received from the United States Fish Commission, and hatched at the Caledonia and Cold Spring Harbor stations.

It is the policy of the commission to give its attention chiefly to what are termed commercial fishes, and in furtherance of this policy 90,000,000 pike perch were hatched and planted as against 41,205,000 in 1895.

This work of hatching commercial fishes has its limits, however, like all other fish cultural work, and the boundary point is the number of eggs that can be obtained.

It is the policy of the commission also to rear as many of the salmon family to eight and twelve months of age before planting, as the facilities of the stations will permit. Heretofore these facilities have been very limited indeed, and in 1895 but 12,750 fingerlings of eight months, and yearlings of twelve months (I say yearlings of twelve months, for fingerlings of eight months are frequently called "yearlings" by courtesy), including brook, brown, rainbow trout, and landlocked salmon, were distributed from the state hatcheries, and none were reared or planted previous to the organization of this commission. As I have already shown, 431,000 are now being reared, and arrangements have been made for building rearing ponds and boxes so that the output will be 1,000,000 in the nearby future.

The experiment was made during the spring of changing trout fry and eggs from the water and food of one hatchery to that of another, much as members of the human family are moved from mountain to sea air, or vice versa, as a tonic, and the result, whether owing to the change alone or from other causes, has been the strongest, most vigorous fry turned out in years by the state, if the testimony of the hatchery men and the people who have received the fry is competent. Not a single complaint has been received that the fry were sick or weak or in poor condition.

Yearling trout have been reared the past year that were nine inches long. I moved one lot of yearling trout, receiving them from a hatchery messenger after a journey of two hundred miles, and taking them seventy-five miles further without the loss of a fish, and there was scarcely one that was under the legal length of six inches. By legal length I mean the length exceeding which trout may be killed by statute when caught. The planting of trout over six inches in length will tend to render the efforts of the commission void in stocking streams to make them self-sustaining, as every one of such fish planted in the spring may be legally caught and killed before they have an opportunity to spawn. It is for that and other reasons allied to it that the commissioners sought to obtain the power possessed by the New Hampshire Commission, and perhaps other state fish commissions, to enable them to close planted streams until the fish become established, or until they have had the opportunity to spawn at least once before they can be legally killed. As the law now stands it presents the curious anomaly of practically nullifying the efforts of the commission to make the planted waters in a measure, at least, self-sustaining, and so far the Legislature has not seen fit to grant to the commission the power it seeks to close such waters for a time.

The great number of applications for fish of various kinds are carefully examined by the commission, and those for private waters are thrown out. If applicants describe waters that are unsuitable for the fish asked for, their applications are also thrown out or filled with fish suitable for the water in question. The commission has issued a circular, a copy of which is sent to each person applying for fish, describing the proper way to handle and care for fry until they are deposited.

At the time the table from which I have quoted, showing the number of fish applied for, was made up, 1,136,075 black bass were asked for. This is a fish, as every one here knows, that is not yet hatched artificially, and the state can supply them only by netting waters in one part of the state to supply waters in another, or by purchase from waters without the state. Last year with an expenditure of $500 the commission purchased and caught for distribution 1,810 adult black bass, and 18,300 fingerlings about two inches long, a greater number than ever before distributed by the state in one year. The law of the state opens the black bass fishing on May 30; and as black bass spawn all through the month of June and the brood of young bass require the care of the parent fish for some time after they are hatched, it seems like wasting at the bung and filling at the spigot to expect the commission to keep up the supply of black bass with the few that they can buy. In fact, I have suggested to the commissioners, informally, that until the close time is changed to cover the breeding season it might be wise to distribute no black bass whatever, for no commission can perform the impossible, and 18,000 two-inch bass—less than one five-pound bass would rear if all eggs and fry survived—will go but a very little way toward supplying the waste of a whole month of fishing during the breeding season.

Another law that the commission has to contend with to keep up the supply of one of the most important of food fishes is the shad law. Before the construction of the Erie Canal in 1825, which necessitated building a dam across the Hudson River at Troy, shad ran up the Hudson to Bakers Falls at Sandy Hill, fifty miles above Troy, and furnished food to a community to which shad is now a comparative rarity. In that day many a farmer came to the river below Bakers Falls and camped until he had secured and salted down a supply of shad for the winter. The Troy dam checked the upward migration of the shad from the time it was built until this day, but good catches of shad were made just below the dam up to within, say, ten or fifteen years ago. Within a few days just passed I have questioned the net fishermen who have applied to the commission for license to net the river at or near Albany for herring, and they tell me it would not pay them to set a net for shad. The present shad law relating to the Hudson provides an open season between March 14 and June 15 for netting shad, "but said nets shall not be drawn nor fish taken therefrom between sunset on Saturday night and sunrise on Monday morning, unless by reason of the inclemency of the weather said nets cannot be drawn prior to sunset on Saturday night, in which case it shall be lawful to take fish therefrom as soon as the weather will permit." With this law in force the commission has been unable to secure a sufficient number of ripe shad at Catskill to keep up the supply of this species of fish in the river without assistance from the United States Fish Commission. It was thought advisable by the commission to amend this section of the law at the session of the Legislature during the past winter, and a bill was introduced which required that shad nets be taken up at sunset Friday night and not fished until sunrise Monday, and it also provided that nets should not be operated by boats propelled by steam. This amendment was for the purpose of opening the river a reasonable time each week to enable a sufficient number of breeding shad to reach their spawning grounds and keep up the stock, in case aid from outside sources should fail. The steamboat clause was for the purpose of putting all the fishermen on the same footing. This bill passed the Senate, but was defeated in the Assembly.

In 1895 unusual efforts were made by this commission to obtain shad eggs in the Hudson, and 3,087,000 fry were hatched and planted, and 4,900,000 contributed to the Hudson by the United States Fish Commission. From 1883 to 1895, both years inclusive, the state planted in the Hudson 33,522,500 shad fry, and during the same period the United States Fish Commission contributed to the Hudson 54,511,000 shad fry from other rivers, or 20,988,500 more than the state was able to supply from the river itself. With these figures, taken from the reports of this commission and furnished to me by Commissioner Brice from the books of the United States Fish Commission, as a basis, one can imagine what the condition of the shad fishing in the Hudson would have become had it not been for contributions of fry from the Delaware and Susquehanna Rivers. This year the shad work of this commission is not completed, but the United States Fish Commission has already contributed to the Hudson 3,000,000 shad fry from the Susquehanna and 2,000,000 from the Delaware.

Contributions of shad fry from other rivers doubtless do more than aid to keep up the supply of fish in the Hudson, as the fresh blood must invigorate and improve the stock.

Since 1882 the greatest number of shad fry the state has been able to plant in the river from eggs obtained from the shad of the river was in 1889, when 6,000,000 were planted. The next best seasons were 1887, 1888, and 1895, when something over 3,000,000 were planted each year. In 1891 the United States contributed 9,348,000 fry, and six other years from 4,200,000 up to 7,414,000 annually.

As to the importance of the shad fisheries of the Hudson and the value of the product, the commission caused an investigation to be made last year covering all the fishing stations from Sandy Hook to Castleton, nine miles below Albany. It was found that 3,471 nets were operated and 1,155,610 shad were taken during the season of 1895. New Jersey is credited with 1,666 nets, operated at eleven stations, and taking 417,829 shad. New York is credited with 1,805 nets, operated at sixty-seven stations, and taking 737,781 fish. The greatest number of nets at a single station is 703, at Alpine, N. J., taking 94,100 shad. Fort Lee, N. J., operates 337 nets, taking 114,300 shad. The greatest number of nets operated from New York stations was 306 at Sing Sing, taking 16,400 shad, and 313 at Nyack, taking 3,853. The nets gradually peter out up stream, until Castleton, with one net, is credited with 500 shad. At Catskill, where the work of this commission is carried on, six nets were operated, taking 5,000 shad.

To get at the weight and value of the shad catch in the Hudson, I asked Ex-Commissioner Blackford to give the average figures of fish received at Fulton Market. He wrote me:

"Regarding the Hudson River shad, I would say that 100 buck shad will weigh 308 pounds, and 100 roe shad will weigh 412 pounds. This, you see, will make their average a little over three and one half pounds. The proportion of bucks to roe shad this season has been sixty per cent. roe shad to forty per cent. buck shad. The average price for the entire season has been twenty cents for roe shad and ten cents for buck shad. The lowest price they have sold for on any one day was ten cents for roe shad and five cents for bucks. For quality and size, the Hudson River shad has been good—rather better than for the last two or three years."

With these figures as a basis, I find that the catch of shad in the Hudson River in 1895 weighed 4,044,635 pounds, and that 693,366 roe shad brought $138,673.20, and 462,244 buck shad brought $46,224.40, or a total for the entire catch of $184,897.60.

The mascalonge work at Chautauqua Lake is in progress at this time, and probably 3,000,000 fry of this species will be planted by the state. The mascalonge of Chautauqua Lake, while structurally like the St. Lawrence River fish, is differently marked, and wholly lacks the round brown spots of the latter. The Chautauqua fish is blotched or banded on the sides with rich brown on a light ground. I believe that no other commission has attempted to cultivate the mascalonge artificially. A number of experiments were made in this work before the hatching of mascalonge was successful. The eggs were tried in the hatching jar and in shad boxes in running water, but finally the eggs were placed in boxes with double screens top and bottom to prevent the eggs being eaten by minnows and other fish, and the boxes were sunk in the lake in still water.

It is difficult to obtain all the eggs from a fish at one handling, but 265,000 eggs have been taken at one time from a female of thirty-two pounds. Only one maskallonge was killed last year of all that were handled. After milting the eggs separate in three quarters of an hour, and about ninety-seven per cent. of impregnated eggs are hatched. With water at 55° Fahrenheit the fry hatch in about fifteen days, and it requires about the same length of time to absorb the umbilical sac. The fry of the mascalonge when first hatched are very helpless, and apparently a prey to every living thing.

This commission is giving considerable thought to the question of providing food for fishes in wild waters, as it believes that many failures to stock lakes and streams are directly chargeable to a lack of proper food for the planted fish. This subject is treated at some length in the annual report of the commission now in the hands of the printer. The steelhead trout mentioned in this paper are the first to be brought to New York, and they will be planted in one of the large lakes in Northern New York and in Long Island streams flowing into the sea. The Scotch sea trout are the first to be brought to this country and will not be distributed at present.

The total output of fish, of all kinds, will be considerably larger this year, when all the work is finished, than last year, when under the old Fishery Commission and the new Fisheries, Game, and Forest Commission combined a grand total of 196,247,840 were planted.

WASTE OF FOOD FISHES.

BY L. D. HUNTINGTON, EX-PRESIDENT OF THE NEW YORK FISH COMMISSION.

The yearly waste of food fish along our coast is a subject deserving the consideration of all interested in the supply of healthful food. The subject should especially receive the careful attention of the citizens of the seaboard states. The waste from the indiscriminate use of the purse net by the menhaden fishermen, along our coast from Maine to North Carolina, demands proper attention and careful consideration. This industry, the products of which are guano and oil (from fish), is one of considerable importance; it is organized under the title of the "United States Menhaden Oil and Guano Association," with a capital of about two million dollars, employing from two thousand to twenty-five hundred men, with annual products of about five or six hundred thousand dollars in guano, and about four hundred thousand dollars in oil, the capital, number of men employed, and value of products varying somewhat yearly; this enterprise should receive proper consideration as a business venture, but not be allowed to trespass upon the rights and privileges of the citizens of the seaboard states, by wasting the food products of the waters of the coast by converting them into guano. In the prosecution of their business (catching menhaden with purse nets) they not only intrude upon the rights of the citizens of the seaboard states, in catching and converting valuable food fishes into guano, but drive the food fish from their natural feeding grounds and prevent the parent fish occupying their natural spawning beds and reproducing their kind.

While it is often denied by those interested in catching menhaden with purse nets that they catch any food fish worth mentioning, I will briefly state one or two of the many items of evidence of the catching and of the wanton waste of food fish by them. In 1892 a bill in the interest of the menhaden fishermen, known as the Laphan Bill, was before Congress, the provisions of which gave them the right to use the purse net all along the coast, in the bays, estuaries, and rivers, limited only beyond the influence of the tide, the law, habits, or customs of any state to the contrary notwithstanding. Strenuous efforts were made to secure this law, which fortunately failed, but, nevertheless, furnishes the plainest evidence of their disposition to override all state laws for the protection of food fish, etc., in their pursuit of the menhaden.

At a hearing on this bill before a Senate Committee the following instances of the waste of food fish were brought out: Mr. S. B. Miller, a fish dealer, in answer to questions asked him, stated that he received at one time 70,000 pounds of food fish, mostly weak fish, from one of Daniel Church's steamers, 10,000 pounds of which went on the market; the balance, 60,000 pounds, went to the guano factory on Barren Island. He also stated that at another time he received from the same source another large lot of food fish from out of which he selected about 10,000 pounds; that the balance of the lot were heated and unfit for sale, and that he told the captain of the boat to haul right out; of course these fish went to the factories; he further stated that with their (meaning the menhaden fishermen) manner of handling fish, the fish after being covered eight inches with other fish as they are dumped in the hold of their vessels would heat and be unfit for use for food in three hours or less.

Mr. E. G. Blackford, the well-known fish dealer of Fulton Market, before same committee stated that from his own knowledge every year those fishes which feed upon menhaden grow more scarce, that there had been several instances which had been spoken of there of his own knowledge where the menhaden vessels have taken large schools of food fish and have brought them to market; the very large catch of 1891, about a year ago, just about that time of the year, was principally of weak fish. Some four or more vessels came up to Fulton Market with a cargo or quantity of at least 200,000 pounds, nearly all weak fish, and out of that 200,000 pounds about one quarter were marketed; the balance of these cargoes was sent to the factories and rendered into oil and scrap. Mr. Blackford further stated that in his opinion the effect of the great amount of fishing that is carried on for menhaden all along the coast breaks up the schools of fish which are followed by the striped bass and blue-fish, and has a tendency to make these fish seek other feeding grounds.

Mr. George Hildreth of New Jersey, formerly a menhaden fisherman, in answer to the following question, *i. e.*, "Well, on the average would there be a considerable food fish?" replied, "There would sometimes be quite a number of food fish among them (meaning menhaden), and other times very little—whatever there was within the bounds of the net." In connection with the latter part of Mr. Hildreth's answer, that the purse net caught whatever there was within its bounds, I will quote Prof. G. Brown Goode—endorsement (Mis. Doc. 49, Second Session Forty-fifth Congress, page 117). He says, "The purse seine is doubtless more effective than any other fishing apparatus ever devised; by its use a school of almost any size can be secured without the loss of a single fish." The enormous demand of the oil factories can be met only by fisheries conducted upon the grandest scale, and the purse seine is used by the factory fleet to the exclusion of all other nets.

The purse net, as Prof. G. Brown Goode and Mr. Hildreth say, takes all fish within its enclosure or bounds, which must necessarily include the taking of a very large quantity of food fish in its use in taking the average yearly catch of 500,000,000 of menhaden.

Agreeable to statement compiled by Hugh M. Smith, and published in the United States Fish Commission bulletin, the number of hauls made by two menhaden steamers for one season is given as 1078, and the proportion of the catch as one twentieth of the menhaden taken for that time; this would give a total of 21,560 hauls made in a season from the best available data on the subject. The average length of the purse nets used by the menhaden fishermen is about 1360 feet; taking the average length of the nets used as 1350 feet, each haul would enclose 3 32-100 acres, which makes an aggregate of 61,589 acres of water along our coasts, bays, and estuaries upon the feeding and spawning grounds of many of our valuable food fishes thoroughly screened of the food fish yearly. The food fish so taken, hastily dumped by steam power by scoops holding five barrels each, in a mass in the hold of the vessel (precluding the possibility of detecting the various species of fish taken with the menhaden, "even if desired"), where they soon sour and become unfit for food, are taken to the factories and rendered into oil and guano. As before stated, it is claimed by many interested in the menhaden fishery that they take but few, if any, food fish with the purse net, while taking yearly about 500,000,000 menhaden. Those who are familiar with the purse net, and not interested in the menhaden oil and guano business, have yet to learn how it is possible for the net to take the menhaden without taking the food fish it encloses, especially when the depth of the water does not exceed that of the net used; so that it reaches to the bottom and encloses a certain space of water, forming a flexible wall from the surface to the bottom, then being pursed up along the bottom, I would ask how is it possible for the food fish to escape and the menhaden only be taken? Aside from the waste of the food fish so taken, the indiscriminate use of the purse net in the shallow waters along the coast, in the bays, inlets, and estuaries, the natural feeding and spawning grounds of many of our valuable food fish, drives them to other localities and seriously affects their natural reproduction.

From such statements of the value of the yearly products as I have seen in print, the proportion gives about sixty per cent. in guano and about forty per cent. in oil. Food fish rendered may not add to the product of oil, but do to the product of guano. The subject of coast food fish supply is one that should especially interest the hundreds of thousands of citizens of the seaboard states; that the present waste of food fish from the indiscriminate use of the purse net by the menhaden fishermen, within the three-mile limit, is an abuse of the rights of all citizens. No business is justified in using food fish, which were intended for food for the people, for the purpose of manufacturing into fertilizers; nor is any business justified the prosecution of which, in any way, interferes with the people's supply of food fish. There should be proper restrictions that would be just to all, to the menhaden industry, as well as to millions of hard working citizens who depend upon the continual food fish supply for a livelihood, the many thousands who at times take fish for food for their families, the many thousands who, of choice, prefer to catch their supply of food fish from the waters adjacent to them, instead of from the market, as well as thousands who resort to the waters along our coasts for food fish as well as for recreation and health; the food fish should be protected within the three-mile limit before it is too late. If the use of the purse net was properly restricted, or prohibited within a reasonable distance from the shores, and used only in waters beyond the depth of the net used, it would go far to stop the present waste and to ensure a continued supply, now so seriously threatened.

I would most respectfully ask the consideration of the members of this Society, and especially those who are commissioners of fisheries of the respective seaboard states, to this important question.

THE PROPAGATION OF SMALL MOUTH BLACK BASS.

BY SEYMOUR BOWER, SUPERINTENDENT MICHIGAN FISH COMMISSION.

At Cascade Springs, Kent County, near the banks of the Thornapple River, is located an experimental black bass station of the Michigan Fish Commission. The present is the third and most successful season of its operation. The water supply to the experimental ponds is derived from spring sources, not far removed, and is, therefore, too cold for bass work as it reaches the ponds, but the supply is so limited in volume that the area of pond exposure is sufficient to nearly equalize the temperature with that of the Thornapple River.

The Thornapple is well stocked with small mouth bass. Their spawning beds are found all along in front, and for a considerable distance above and below our experimental ponds, thus affording an excellent opportunity, in connection with the pond work, of observing their natural spawning habits and the results.

This station was not established with any idea of permanency, nor with the expectation of hatching any considerable number of bass—the water supply is too limited for that—but rather to acquire practical knowledge by experience, experiment, and observation, so that when funds are available for a large plant they may be expended wisely and efficiently.

Having no special fund for even experimental purposes, the work has necessarily been limited to a small scale of operations. In the summer of 1893 two ponds were excavated. The upper pond was to be used for experimenting in the direction of artificial propagation; the lower, and much the larger, pond was to be devoted to pond culture. During the fall a stock of about 150 adult bass was collected from the Thornapple and placed in these ponds. The fish carried well the following and subsequent winters, and also in the summer, although the temperature in the lower pond rises to ninety degrees at times. No losses of any consequence have occurred, except as a result of handling during the spawning season.

In the larger pond the fish have not been disturbed during the breeding season. In the month of May, 1894, ten beds were made in this pond, from which 32,000 fry were taken as they rose in schools. This does not represent the number hatched, but the number saved, as a part of some of the schools had dispersed before it was discovered that they had risen.

The following spring, or one year ago, this pond was unproductive. Owing to extreme dry weather the supplying springs nearly failed at times, and the water in this pond became stagnant and quite foul and roily. When it cleared up a few beds were observed, and it is quite probable that a few fish spawned notwithstanding the unfavorable conditions, but if they did the beds were undoubtedly cleaned out by a large snapping-turtle that was discovered in the ponds at the time. There is no doubt that turtles have a special fondness for the eggs and fry, as by actual observation two beds in the river are known to have been despoiled in this way.

The present season the shoal margin around the upper end of this pond is literally "peppered" with beds, and the outlook is most promising. There are sixty adult fish in the pond and eighteen beds are in sight. Five of these beds are non-productive, but the other thirteen will yield about 70,000 fry, 60,000 having already been collected from eleven of the thirteen beds.

The fish in the upper pond were reserved for experiments in the line of artificial propagation. Beginning with the first spawning season, 1894, they were not disturbed until they had commenced to prepare the beds; they were then seined up from time to time and examined. Early in the season one ripe female was found and a portion of her eggs were taken, but there were no ripe males in the pond, so a male was opened, the spermaries removed and pressed out in water which was poured over the eggs. Number of eggs taken 2100; number hatched 700, or thirty-three per cent.

A number of the females were quite soft when first handled, but hardened up with further handling and failed to spawn at all. Bedding was also discontinued, and interference with the natural spawning was resented to that extent that they made no further effort to spawn in a natural way. Not a fish was hatched in the pond and only 700 by artificial propagation. So this experiment was a failure.

A few days later a pair of bass were seined from their bed in the river as they were at the point of spawning, but no eggs or milt could be obtained. They were held in a tank seven days, then removed to a small pond with gravel bottom, but they made no effort to spawn, and finally fungused and died. Another pair was captured in the river while in the act of spawning, a few eggs having been cast; the eggs came freely, but as no milt could be pressed out, only 500 were taken. By opening the male a very little milt was procured, and about 200 fish were hatched from the lot.

The next spring, or one year ago, a small side pond about nine feet by twelve was excavated and connected by a short raceway with the pond in which the failure of the preceding year had occurred. This side pond carried only eighteen inches of water, a favorite depth selected by the fish in the river for spawning; and being much shoaler it would also grow much warmer, and, therefore, more attractive for the spawners than its larger and deeper consort. The bottom was covered with gravel and small cobble stones, and everything done to make the little annex as inviting as possible. No one but the attendants was allowed to approach the pond during the spawning season. A "blind" was provided near by, from behind which all the proceedings, from the initial step of preparing the beds, to the final rising of the young fish, could be observed without intrusion.

The result more than justified expectations. There were no indications of bedding in the deeper pond, but in two instances, at least, the males literally fought over the possession of the bed in the little annex. Eight beds were made—there was n't room for any more. Three pairs were lifted from the beds, of which one was spawning at the time, but as usual no milt could be pressed out, or only a minute "speck" or fraction of a drop.

No further effort to handle the spawners was made. As the last three pairs handled had not been touched or disturbed in any way, or at any time, until they were at the point or in the very act of spawning, we concluded that while occasionally, under peculiar or accidental conditions, a few eggs might be taken and fertilized, all efforts to reduce the business to a successful working basis would prove useless and futile; further experiments might be interesting, but would result in no practical benefit.

There is probably an appreciable space of time during which the spawn may be taken and fertilized, but this time is not known, and it would not be practical any way to isolate each pair, as it would be necessary to do, and provide the constant surveillance necessary to insure seizing the opportunity. Moreover, it would be unwise to take the eggs artificially even if it were entirely practical to do so, as we could never hope to equal the natural hatching percentage. Given protection against turtles and water snakes—the male bass will take care of all other intruders—and the natural hatching percentage will often be as high as ninety. Artificial manipulation of adhesive eggs has never reached that figure, and probably never will.

Although to some extent a repetition of the above, I quote from my report in writing to the Board, filed shortly after the close of last season's bass work: "Previous experiments and a careful observation of the conduct of the parent fish prior to and during the act of spawning, lead to the conclusion that the artificial taking and impregnation of bass eggs is possible only when undertaken at exactly the right moment, or within the limits of a period so brief as to admit of success only on rare occasions. A preliminary coaxing and caressing by the male seems imperative, not only to bring the female to the point of spawning, but also to develop the milt. These preliminary proceedings are sometimes carried on for several hours, and again for only a few moments; if interrupted or handled at this time, or prior to the orgasmic stage, neither the eggs nor milt will flow; so that artificial impregnation may be accomplished only during the few moments of actual spawning, or after the natural spawning has begun. Under the strictest surveillance the opportunity is too seldom presented or known for practical operations in this direction. In any event, however, we would lose instead of gain by the artificial handling of bass eggs, owing to the relatively high percentage of natural results in protected ponds and the relatively low percentage of results by artificial treatment of adhesive eggs."

To refer back to the annex pond: After concluding to allow the natural spawning to proceed without interruption, the fish continued bedding, and when the fry were nearly at the point of rising, the fish that remained to guard the beds were driven out and the pond screened against the parent fish and to prevent the escape of the young. After rising and scattering they were scapped up as wanted for shipment. Total results of this pond for the season, 16,000 fry, all taken from five beds, as three beds were unproductive.

This year there are eight beds in the annex and one in the connecting raceway. Six of these beds are now black with fry, and will yield 20,000 to 30,000. There are thirty adult bass in the pond. The water is a little colder in this pond than in the lower one, hence the fry are a little later in rising.

The perfect success of the little side pond, both last year and this, indicates the style or system of ponds best adapted to the culture of small mouth bass. The storage pond should be quite large and of good depth—say four to eight or ten feet deep. Plenty of boulders should be provided, for shade during the summer and to hover around, as the bass is wont to do while in the torpid condition of its winter retirement. This pond should have no gravelly shoals or margin to encourage bedding, but should be nearly surrounded with small shoal ponds, each connected with the main pond by a short raceway, and made as inviting as possible for spawning purposes. No fear need be entertained that the fish will not seek the side ponds at the proper time. It is demonstrated that, with a suitable water supply, the question of propagating small mouth bass on a scale to provide for large and effective distributions, is reduced to the simple proposition of providing the ponds and breeders.

A few scattering notes in connection with the subject of bass propagation may be of interest, and, therefore, are submitted.

In the Thornapple River the beds are made along the shores in from one to three feet of water, and where the current is very moderate—never in rapid water. A circular ridge of sand and gravel is thrown up and the bottom of the hollow thus formed—always of gravel and pebbles or small cobble stones—is swept bright and clean. This work is almost invariably done by the male, though in a few instances the female was present—which is not usual—and was seen to render some assistance; but this occurs only when the female is under great stress of haste to spawn. In such cases the preparation of the beds had been delayed too long; or they may have been driven from their own beds, duly prepared, by a pair whose bed had likewise been usurped.

Mr. Dwight Lydell, who is in charge of the bass work during the spawning season, and a careful and intelligent observer, was recently an eye witness to an incident of this nature. While watching a pair of bass going through the preliminary manœuvring that precedes the actual spawning, another pair approached the bed with the evident intention of appropriating it. The males at once began a fight that grew quite furious at times, and lasted about an hour. The females took no part, but rushed about in great apparent distress. The rightful owner of the bed, although much the smaller, proved the victor, for the would-be usurpers finally dropped down stream about ten feet and immediately commenced to whip out a bed of their own. They worked rapidly and in forty minutes the bed was ready. Then, after a few moments of sexual sparring, the spawning was begun and completed in five or six minutes. Meantime, the other pair resumed business and in forty-five minutes had completed preliminaries and finished spawning.

The preparation of beds is usually begun in the latter part of April or early in May, though the spawning does not follow, as a rule, until several days later. This year the males began working on the beds in the annex pond on April 30; the first spawning there was on May 8. At the beginning of the season the males work on the beds only occasionally, and suspend work entirely during a cold storm or a spell of cold weather; but as the season advances matters are hastened and preliminaries shortened.

When the bed is ready and the male has induced a female to accompany him to it, there follows a series of movements quite impossible to describe. Generally the female is coy and diffident at first, and inclined to leave, but after much manœuvring and persuasion by the male, is rounded up and reluctantly remains. The male grows more active and ardent; his movements indicate strong sexual excitement and a desire to induce excitement in the female; coaxing and caressing alternate with bunting and biting various parts of the body, but chiefly around the vent. Then the male glides slowly over the bed with a peculiar, trembling, fluttering movement, while careened over nearly on his side. Soon the pair crosses the bed slowly, duplicating the spasmodic flutterings, each leaning over outward, thus bringing their vents close together, although the female is always slightly in advance. The bed is crossed in like manner at intervals of ten to twenty seconds until the spawn is all cast, which usually takes from five to ten minutes. The preliminaries that lead up to the spawning last much longer, as a rule, than the act of spawning, and sometimes fail altogether. In one instance a male was seen, after an hour's ineffectual effort to induce spawning, to drive the female back to the main pond and return in a short time with another. While the female is spawning the entire body is strongly mottled, but resumes its normal appearance soon after spawning and leaving the bed.

In a paper presented before this Society at its seventeenth annual meeting, Mr. C. S. Holt stated that the male and female bass prepared the bed jointly, and that the female guards the young; but he has since acknowledged to me that later observations have convinced him that he was in error. It is positively known that, except under circumstances heretofore noted, the male bass assumes both of these duties. A number of fish have been captured while performing either function, and the identity of the sex established by removing the spermaries.

In size and color the eggs of the small mouth bass correspond very closely with those of the fresh water herring, being, perhaps, the least trifle smaller in size and a little deeper in color. They will approximate 80,000 to the quart.

The number of eggs per female will range from 2,000 to 10,000 or more. It is quite rare that so few as a thousand fry rise from a bed, and as many as 8,000 have been taken from a single bed in the river, but 3,000 to 6,000 is the usual number.

The length of the hatching period, so far as observations have been made, varies from seventy hours, at an average temperature of sixty-six degrees, to one hundred hours. A merely casual inspection will fail to detect the hatching point, as the fish at first is all sac, which is of the same size as the egg and looks just like it; but on closer examination it will be noticed that the sphere is slightly elongated and a very faint, shadowy line will be seen to extend about one third the way around the sac. But the development is very rapid, and in from six to fourteen days, according to temperature conditions, "the sac that is all sac" has become a black, vigorous, young fish. The black blanket of fry that now covers the bottom of the bed is ready to rise, and they begin to swim up and form a school, which usually holds together two to four days-but may break up in two or three hours if the temper, ature is very high. On the other hand, the schools have been seen to settle back on the beds and remain a few days longer when there is a sudden and marked change to colder weather. They also usually settle back on the bed at night for the first two or three nights.

In the river the schools do not at first disperse in all directions; they head up stream, some barely holding even with the current, some dropping back, and others forging ahead and making some headway; thus gradually stringing along out in thinly scattered lines.

In addition to the small mouth bass fry furnished by the Cascade ponds, 20,000 were collected from beds in the Thornapple during the season of 1894, 73,000 in the season of 1895, and 62,000 so far this season. We also collected and distributed last season 145,000 fry of big mouth bass, all taken from beds around the margin of Laraway's Lake, near Cascade. So far this season 12,000 have been taken from the same lake. The beds of the big mouth bass are found on and among the roots of pond lilies and various water plants and grasses.

Referring again to the pond feature of the present season's work, it should be noted that a total of ninety adult male and female bass in two ponds have so far produced 60,000 fry for shipment, with 30,000 to 40,000 more in sight.

FISH AND GAME PROTECTION IN NEW JERSEY.

BY H. P. FROTHINGHAM.

I have been asked to present to you my views on the progress made in the protection of fish and game in the state of New Jersey, and I shall do so in as brief and still as comprehensive a manner as possible. It would be useless for me to say anything to you, gentlemen, on the necessity of such protection, and, consequently, I shall at once proceed to give you my views as to why fish and game are not better protected in New Jersey, and I feel confident that a great deal of what I shall say pertaining to New Jersey will apply to a considerable extent also to other states.

The average citizen generally pictures to himself as the worst enemy of fish and game the man who goes skulking through the forest looking after traps, or, armed with a gun having a calibre of a ten-pound cannon destroys everything that presents itself in fur or feathers. Then we also hear of the man who sneaks to the river shore at night with huge nets, and with one sweep captures enough fish to supply the fish markets of New York for a week. Again the picture is presented to us of the farmer who jealously guards his property against all trespassers, in order that his revenue may be increased by unsportsmanlike methods of taking fish and game. From still another quarter comes a cry that if fish wardens were more vigilant violators of the law would be fewer in number. To offset this there arises a cry that wardens are unmerciful and frequently enforce the laws to the letter, where common sense would dictate the exercise of clemency.

Now, I have no doubt whatever that if we could do away with all these objectionable features there would be more fish and game, and more happiness generally; but in my opinion we must look further for the causes which tend at the present day towards the decrease of fish and game, and among the first and greatest of these causes I should class injudicious legislation. In the halls of our Legislatures protection to fish and game is not always the impulse which actuates the law-makers in passing laws pertaining to the protection of fish and game. Too frequently laws are introduced and passed for the purpose of attaining some private end, or for the purpose of gratifying some particular friend of one of the legislators, and although these laws as applied in the particular cases which gave rise to their enactment may be harmless, they too frequently do mischief in localities for which they were not intended. Then again, there is at times a disposition on the part of the law-makers to go too far, to provide penalties out of all proportion to the character of the offense sought to be punished. What is to be thought of a law, for instance, which provides that corporations which disturb the habits of fish shall be imprisoned for two years, and which gives every Justice of the Peace in the state the right to impose this penalty? Under this law a Justice of the Peace in Squedunkville was empowered to send to state prison the Erie Railroad Company, the Standard Oil Company, or any other corporation, officers, directors, stockholders, agents, and all for having interfered with the spawning of a sucker. Still this law existed on the statute books of New Jersey during the present generation, and the commissioners and wardens were, by virtue of their oaths of office, supposed to enforce it. I might call attention to other laws equally ridiculous which you will find on the statute books of some of the states, but I trust that there is no need of my citing any others for the purpose of explaining my meaning. A law in order to be properly enforced must be respected; it must be free from those absurdities which frequently serve as a justification on the part of the general public for a continued violation of a great many of our laws. The public is very quick to perceive the motive of a law, and if this motive does not command respect you cannot hope that the law will do so. If a law is passed for the benefit of a certain individual, or a class of individuals, or if its enactment is dictated by politics, it at once becomes inoperative to a certain degree, and, what is worse, the odium attaching to one law is apt to taint all others. Friends of proper fish and game legislation may camp out in the corridors of our state capitols, within easy gunshot of the Senate, the House of Assembly, and the Executive Chamber, but in spite of all their watchfulness some obnoxious features are almost sure to creep into laws pertaining to fish and game. Eternal vigilance may be the price of liberty, but you cannot obtain consistent fish and game laws at the same bargain.

The next evil concerning which I desire to say a few words is the direct result of the foregoing. Inconsistent legislation conveys the idea to the mind of the casual observer that fish and game laws are passed for the benefit of a very few, and to the injury of the masses. Thus, in New Jersey a great deal of fault is found with the laws governing the taking of fish by the use of nets in the inland tide waters. These laws are more numerous even than the bodies of water to which they apply, for some of the creeks have different laws every few miles, and what is lawful on the north shore of a bay may be criminal on the south shore. This inequality of regulation gives rise to numerous complaints, and I cannot say that the majority of these complaints are not well founded. The commission at the last session of the Legislature attempted to secure the passage of a uniform law concerning tide water; our wardens had ascertained the desires of the people living along the sea coast, and it was presumed that the proposed measure would meet with little opposition. We felt confident that the vast majority of those directly interested approved of the law as suggesed by the commission, but it was this large majority that remained at home, confident that their interests would be taken care of; on the other hand, each individual who wanted some privilege not enjoyed by his neighbors, under the old laws, and each man who thought he knew all about salt water fish and their habits, because, perhaps, he might have smoked herring or made fish barrels for a year or two, hurried to Trenton, and altogether there was such a din of opposition that the legislators buried the measure in committee. The result is that particular localities and certain individuals enjoy privileges not common to all, and the impression continues that our fish and game laws are not made for the benefit of everybody, but that they confer special rights on a favored few. Our laws pertaining to shad prohibit the taking of this fish on Sundays, and the law is a very wholesome one, as it permits the shad to ascend to their spawning ground unmolested for one day in the week. This law is objected to by some, because Delaware, our neighboring state, has no such restrictive legislation. Jerseymen complain that they are not accorded the rights enjoyed by their competitors in Delaware. They seem unmindful of the fact that the circumstances in New Jersey are wholly different from those in Delaware, that the shad water over which the latter has control is small compared to the Delaware River, and that laws which apply to the bay would not be suited as well to the river. Still there is here an apparent inconsistency, sufficient to afford an opportunity to the carping critic. Unfortunately, the faults in the fish and game laws are ever being paraded before the public. What is true of the law protecting food fish is also true, in a measure, of the laws protecting fish whose principal use is to afford sport for the angler, and what is true of fish is also true of game. Thus, in New Jersey, on account of its geographical position, there is a continual contention between the gunners of the northern and of the southern part. The former want an early open season, and the latter prefer to do their shooting later, and both are right, for there is a difference of two or three weeks in the seasons between the two sections. No matter how the law is framed it will be partial to one or the other. It is consequently not at all a matter of surprise that people should argue that fish and game laws are made for certain localities and individuals, and not until people alter their opinions and are taught to believe that fish and game laws are passed for the benefit of all, that they are not intended to be restrictive of the liberty of any person or class of persons, but that their sole object is the preservation of animals for the enjoyment of all who love nature and sport, will our fish and game laws receive that support to which they are justly entitled.

Another evil working against the proper enforcement of the law, and one bearing a close relationship to the foregoing, is the method of conducting politics at the present time. Too frequently are laws dictated by political influence, and too frequently are appointments interfered with in the same manner. Men who are appointed to office, and who are desirous of doing all in their power for the protection of fish and game, are hampered by the power of politics, and this is frequently too great to be ignored. Concessions to those in high political authority are necessary at times, and men entrusted with the enforcement of the laws are required at times to wander from what they recognize as the strict path of duty, for the purpose of placating a power which, if offended, might wipe out the entire machinery of fish and game protection. This may not be a pleasing statement to make, but I am willing to leave it to any one who has had experience in the enforcement of laws whether he has not at times felt the influence of the political boss, and whether such influence was not prejudicial to the cause of sport.

In connection with legislation and the enforcement of the laws, I desire to say a few words concerning the attitude of the newspaper press of the state, and I say, with perfect frankness, that the newspapers have been with us on general principles, and opposed to us in nearly every particular. This may seem strange, but it is easy of explanation. The average human being desires to see the perpetuation of useful animals of all kinds, and, consequently, favors such restrictive or prohibitive legislation as may be necessary to attain that end. It is on this account that the press supports laws and measures advocated by the commission, and we have no better friends than editors and reporters. But let a violator of the law be brought to book and another tale unfolds itself. The idea of protecting fish and game is all right, but the man who is called upon to pay twenty dollars for having killed a rabbit or a song bird is certain to have the sympathy of a great many people, and this sympathy is almost always reflected in the columns of newspapers. The general principle is lost sight of in the extending of sympathy; the warden's side of the story is not sought for, but everything that may extenuate the circumstances of the offense is dwelt upon, and in nine cases out of ten it is made to appear that the prosecution was unjust and uncalled for. The editors of newspapers and a great many other people seem to be in the position of the character in the play who was in favor of the law, but against its enforcement.

In relation to the men who violate the letter of the law I shall have very little to say. The wardens appointed by the commission have been doing some very good missionary work; their general terms are twenty dollars a lesson, although the price charged varies with the conditions of the occasion. I have known cases where wardens, out of sympathy for some poverty-stricken offender, contributed towards the payment of the fine and costs; and I have known cases where unusually stupid pupils were "kept in" for ninety days. Perhaps two little stories just recurring to my mind may give you some idea as to the character of violators of the law in New Jersey. A warden had made a complaint against a man for having taken three trout under the legal size; the accused promptly admitted his guilt and inquired of the Justice how much his experience would cost him. "Sixty dollars and the costs of prosecution," was the reply. "That is rather a high price to pay for three little trout," replied the offender, as he reached down into his pocket for his wallet. "I should say so," chimed in one of those individuals who are so frequently found in courts of justice; "I tell you these fish and game laws are nothing but outrages on the public; they are made for some brownstone front dudes with silver thingum-ma-jigs to go fishing, and they are nothing but robbery as far as the poor man is concerned." The defendant stopped for just one instant in the exploration of his pocket, apparently astonished at the interference, and then produced the necessary funds and liquidated his indebtedness to the state. Then turning to his would-be-defender, he said: "I think, my friend, you are mistaken. The fish and game laws are all right, and

I should have known better. Even if there were no law against the taking of small trout I ought to have known better, for I am old enough and have fished enough to know that if all the little fellows are taken out there will never be any big ones. The game laws are made for the poor more than for the rich, for the rich can go to Canada or the Adirondacks and get all the fishing and hunting they want. But the poor have to stay at home, and these men," pointing to the warden, "are trying to preserve some fishing for the poor man. It serves me just right, and I know you are wrong. Come, warden, have a drink with me." In another case a warden was called upon by a well-known guide from Greenwood Lake, who said to him: "Mr. Warden, I wish that you would prosecute me. I have been keeping a set-line in the water, and I don't want you to arrest me." "Had you not better wait until I secure the evidence?" inquired the warden. "Oh, no," was the reply; "I have done wrong and I am willing to pay for it; besides that, you will get the evidence fast enough, and then I'll have the bother of going through this when, perhaps, I have less time than I have now. Besides that, I don't want to have those fellows up there say that I have been arrested, and so I want to square up now." The warden did not exactly like the turn affairs had taken, but the guide insisted, and so the warden accepted the amount of the fine and costs. On the following morning he appeared before the Justice of the Peace and as warden complained that a certain guide had violated the law; as attorney for the accused he entered a plea of guilty and paid the penalty stipulated by law.

I have said, gentlemen, that our wardens have done some missionary work, and I think you will agree with me as to the quality of this work when you see that it made a defender of the laws out of a man who was paying sixty dollars, and that it touched the conscience of a Greenwood Lake guide. The violators of the law, gentlemen, are with us; now, if we can convince the people that fish and game laws are passed for the benefit of all, and that the faults of these laws are not due to their principle, if we can induce the politicians to keep their hands off, and if we can persuade the press to give us a consistent support, the cause of protection for fish and game will be materially advanced. A campaign of education among the masses will be more fruitful of good results than the application of the rigors of the law to the offenders.

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*At the meeting of this Society in 1895 it was resolved that the Governors of the several states of the United States be made honorary members of the American Fisheries Society, and accordingly all the Governors of the states and territories then in office were notified of their election, and the names of so many of the Governors as have accepted election to such membership are given in the list herewith printed.

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OF THE

AMERICAN FISHERIES SOCIETY

AT ITS

TWENTY-SIXTH ANNUAL MEETING

HELD AT THE RUSSELL HOUSE, DETROIT, MICHIGAN,
ON THE 17TH, 18TH AND 19TH DAYS
OF JUNE, 1897.

SPEAKER PRINTING COMPANY,
DETROIT.

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PROCEEDINGS OF AMERICAN FISHERIES SOCIETY AT ITS REGULAR MEETING HELD AT THE RUSSELL HOUSE, DETROIT, MICH., JUNE 17, 18 AND 19, 1897.

FIRST DAY'S PROCEEDINGS.

The Society was called to order by the President, Mr. Herschel Whitaker, at 10 o'clock a. m., June 17th, and the following members were found to be present:

J. E. Gunckel, Ohio; H. W. Davis, Michigan; H. A. Sherwin, Ohio; Prof. E. A. Birge, Wisconsin; Seymour Bower, Michigan; J. C. Parker, Michigan; W. J. Hunsaker, Michigan; Geo. F. Peabody, Wisconsin; F. N. Clark, Michigan; W. L. May, Nebraska; F. B. Dickerson, Michigan; Edwin E. Bryant, Wisconsin; Currie G. Bell, Wisconsin; W. D. Tomlin, Minnesota: James Nevin, Wisconsin; Henry Russel, Michigan; Herschel Whitaker, Michigan; Geo. B. Davis, Michigan; J. W. Titcomb, Vermont; J. J. Stranahan, Ohio; W. P. Manton, Michigan; Hoyt Post, Michigan; Bryant Walker, Michigan; John Bissell, Michigan; Jas. A. Dale, Pennsylvania.

The President: Gentlemen of the American Fisheries Society: I am glad to welcome you here to the city to our Twenty-sixth Annual Meeting. We are laboring under a little disadvantage this morning from the fact we haven't the report of the Secretary. At the last moment I received a communication from him saying that a business engagement would prevent his coming, but that he would send on his report and the papers connected with his office. Those have not yet been received. We are also unfortunate in not having our Treasurer with us. He has forwarded me, however, his report, his vouchers, and all papers in connection with his office, which will be submitted at the proper time and referred to a committee.

The asparagus has sprouted, gentlemen, green peaches are in the market, life is no longer a burden, the legislatures have adjourned, and there is a prospect that Congress will do the same soon, and I congratulate you upon the renewed chances of success in the country for these reasons. I hope that the meeting of the American Fisheries Society will be productive of much good to the participants, and that the papers will be as instructive as they have been in the past.

It becomes my pleasure to introduce to you, on behalf of the gentlemen anglers of Detroit who are to entertain us during your stay here, a gentleman who, though old in experience, is not old in years, and who came to the realization after years of activity, that there were other things in life good for men to know besides business. He has developed into one of our most accomplished anglers and it is unnecessary for me to say he is a most accomplished gentleman. He has left the small streams and brook trout as little side issues, and goes to the salmon streams for his sport. I have great pleasure in introducing to you Mr. Henry Russel, of Detroit, who will speak on behalf of the anglers of the city.

Mr. Russel: Gentlemen, it is difficult for me to make the few formal remarks which I am expected to make after the glowing introduction of my friend Whitaker, but it seems to me in the few words of welcome I can give you I can congratulate you that you have no secretary or treasurer present. Those two offices seem to smack a little too much of business. And if you can dispense with them at this meeting and during your visit to our city, and if you will occupy your thought and attention with other things which we will endeavor to spread before you, I do not know but your meeting will be all the more profitable.

Your President, and my friend, in whose great knowledge of fish and in whose skill as an angler we all take pride, notified me he would ask me to speak in behalf of the friends of angling and to welcome you to our city, and I assure you it is a great privilege to lay aside business cares, for the time at any rate, and extend to you our hospitality. To some of you whose names are household words in Michigan, I need not say anything in the way of welcome, for you know you are always welcome. Now, Mr. Herschel "Whitefish" Whitaker, as he is sometimes known—and I want to explain at the outset in respect to that, that he is so full of fishing lore, he has had so many experiences that many of us believe he is the man that took down the shorthand notes of St. Anthony's sermon on fishes—we know he has a shorthand way of casting, and he brings to bear his great skill whenever he strikes a fish—Mr. Whitaker has not come to me in any way as a lawyer, railroad man, banker, or manufacturer, nor even as a representative business man to request me to address you this morning, and I wish to say to you I want you to forget business, for I am the Chairman of the Fontanalis Club, and I come before you to-day hoping that all my business delinquencies will be forgotten.

You come to the Land of Lakes, as the name of Michigan implies. The inland lakes and streams are more numerous in Michigan than in any other State in the Union. The State, as you are aware, is composed of two peninsulas, surrounded by lakes which are seas in their extent. Every variety of fresh water fish constitute the denizens of these inland waters, and it is a curious thing, not only in the experience of boyhood, but of manhood that every boy in Michigan all through the interior of the State grows up with a knowledge of the habits and is able to distinguish all the different sorts of fish. In this community, in Michigan, fish has been so important an article of food, and there has been so much of a tendency to turn to fishing as a sport that the people in our community, far more than those of any other place, are able to know all the varieties and the habits and character of our fish, our black bass and whitefish and trout, and we have here what distinguishes us above other places, the rare and gentle grayling.

Our State in the past has not been unmindful of the value of this, and both from the point of sport, and from the commercial point of view the state has fostered these fertile waters. It is true our state commission has, like all the rest of the industries, had a contest, but notwithstanding this they are "still in the ring." But we know this, that in the state of Michigan with the results of the work of our commission before us and the feeling of the state of Michigan towards both the cultivation and propagation of fish for sport and for food, there will be only a temporary abatement in the prosecution of the work of the distribution of fish and the development of our fisheries. They have done so much and the work has been so well done that we have no fear of the future. The greed of the destroying fishermen will overreach itself and I believe I speak with a knowledge of state affairs in stating that while a false economy may for a time restrain the work of the Fish Commission, there will be a change of sentiment pretty soon, and there will be a sowing upon the waters of this state which will be sure to bring forth a good harvest.

Now, gentlemen, that you are here we want you, as I have already intimated, to lay aside business as much as possible, we will endeavor to persuade you to do that, and we only ask you to study the object lessons we shall give you. We propose this afternoon to get a couple of "fishing smacks" and take you to the great and famous bass grounds of this country, the Lake St. Clair fishing and shooting grounds; and from there, after supper, we will come down in the evening to the city, and to-morrow the town is yours and I may add the fullness thereof as well. (Applause.) To-morrow a "fish car!" train will be made up by the railroad and you will be hauled to Paris, and there you will spend the day and we trust you will come back in "fair round belly with good brook trout lined." When you return from there, and not until after you return, you are expected to think of business.

I read an anecdote the other day of Dr. Beale, the Bishop of Durham, which seems to me full of good sense. When writing one of his most important works he was asked when it would be finished, he replied, with great good humor and perfect sincerity, "Oh, I will undertake to take hold of that and push it to an accomplishment as rapidly as possible after the fly fishing season is over." (Applause.)

The Chair: It will become necessary for the Society to elect a temporary secretary and treasurer. The chair is prepared to entertain a motion to that end. Will some member make the motion?

Dr. Parker: I move that Mr. May, of Omaha, Nebraska, be elected Secretary.

The motion was supported and unanimously carried.

On motion, duly seconded, Mr. Freeman B. Dickerson was elected Treasurer pro tem.

The Chair: Gentlemen, you are probably as well aware as I am, that the duties of a President of this Society begin and end practically with the meeting. During the interim between the meetings there is little or no business to be transacted, therefore it does not become necessary for the President to submit a voluminous report.

The year in fish culture has been about what it has been in former years, with perhaps the exception of the conditions in this state. Most of you are aware undoubtedly that the legislature in its unwisdom saw fit to very largely reduce the amount of money appropriated for the current expenses of the Board of Fish Commissioners of Michigan. I only refer to this here, as the matter is quite likely to come up in some shape hereafter, so this society will be informed as to what the meaning of it is, provided it should prove to be a permanent thing. It affects not alone Michigan but the standing of all our interests in fish culture, because the circumstances that surround the temporary suspension of this work, which perhaps may become permanent, in my own judgment affects every single commission in existence in this country to-day, and to that extent the other commissions are interested in this subject. It is a question, I may say, without going into the matter very fully, which surrounds the success of fish planting generally. It is a question of the proper protection of fish and in every sense affects the question of fish planting. A proper administration and application of public funds should have in view the idea that the work done shall be followed with good results. That in a nutshell is the question, and I say it is likely to come before you later on and it seems to me it is a matter that ought to interest us all.

It will be necessary for us to make some recognition of the death of two very prominent members of this organization in the last year, the death of each of whom will cause vacancies in this society that it will be hard to fill. It falls with peculiar solemnity upon those of us who have long been members of this association and who had come to know such men as Mr. Ford, of Pennsylvania, and Mr. Fitzhugh, of Michigan. Mr. Ford was one of the foremost men in the promotion of the interests of fish culture in his own State. He was one of the men who contributed most largely to the success of this Association. He was a conscientious gentleman, an expert fish culturist, a man of broad views and a man who has given this society a standing in his own community and wherever he was known. It will become necessary for us to take some steps to properly recognize his death. I understand the gentleman from Pennsylvania has a memorial which will be offered at the proper time.

We have also lost another member who was one of the finest characters I have ever known. He was a Michigan man; he was a gentleman angler, a man whose heart was as gentle and as good as a woman's, a man whom it was a plesaure to know as a personal friend, a man who "wore his heart upon his sleeve" for his friends, a gentleman who was connected more directly than any other man in the United States with the identification of what is now known as the Michigan grayling, Mr. D. H. Fitzhugh, of Bay City. It was my pleasure to know him intimately, and his death came to me almost as a personal bereavement. I hope that a proper recognition will be made when the time comes of the death of these two gentlemen. There are possibly others whose decease has not come to my knowledge, and if so it will be proper to take some action upon those.

During the last year there have been, as will be revealed by the report of the Secretary, some resignations, and among them one to which I wish to call your attention and I would suggest that proper action be taken upon the same. Mr. Fred. Mather, one of the founders of the American Fisheries Society, a man who has probably contributed as largely to the success and interest of this Association as any man in this country, as most of you are aware, terminated his connection with the New York Commission something like two years ago. Certain personal reasons led Mr. Mather to feel that he should withdraw from the Society. My own judgment, and I believe that view will be sanctioned by every gentleman here who knows him, is that he is justly entitled to become a life member of this Association for what he has done for it. I would recommend in my suggestions to you that action be taken to this end, as it seems to me an eminently proper one.

The question will come up with reference to the time and place of meeting, and it is customary to appoint at the first session committees on the place of meeting and on nomination of officers. That will be in order pretty soon.

I think Mr. Russel has outlined to you what the programme is here. At 2 o'clock, city time, we are expected to leave the foot of Third street on two private yachts, kindly donated by Mr. Smith and Mr. McMillan.

I think an opportunity had better be offered at this point for the presentation of names for membership, as has been the custom, and if any of you gentlemen have the names of persons to suggest now is the time and the Chair will be glad to hear them. I myself suggest the name of Dr. W. P. Manton, of Detroit. I have another list of proposed members which I have left at the office, but will bring in later. I also propose the name of Mr. Henry Russel, of Detroit.

I think the first thing in order will be the appointment of a committee on membership to pass upon candidates. The constitution requires they shall be elected by a two-thirds vote. I think it is hardly necessary for a motion, and I will appoint as a committee on nominations for membership Dr. J. C. Parker, of Grand Rapids; Mr. Geo. Peabody, of Vermont, and Mr. F. N. Clark, of Northville. The Secretary will give them the names of candidates and they will report at once.

While we are waiting for that committee I want to say one thing further which should have been in my verbal report of the proceedings of last year. At the meeting of the Association last year the following resolution was adopted:

"Resolved, That the President appoint a committee of one member from each of the seaboard States, to whom the subject of Mr. Huntington's paper shall be referred with power."

Mr. Huntington's paper related to the protection of fish in the ocean along the seaboard States, and a resolution by Mr. Dickerson was offered in connection with it providing for the appointment of a like committee from the lake States. I subsequently wrote Mr. Huntington for suggestions as to who the committee should be from the seaboard. He gave me the names of several gentlemen who were not members of the Society. While I had no particular objection to appointing these men, and have no doubt they would have acted cheerfully, at the same time I did not know what authority this Society had to nominate men to act upon a committee when they are not members of the Society, and I therefore declined to make those appointments. I think no injury has been worked, but it seems to me that the Society could not with any proper sense of dignity, nominate men on committees to act for it over whom they had no power even of membership, and after thinking the matter over I came to the conclusion it was a matter that had not been considered in that light at the time the resolution was offered, and I therefore made no appointments. That is the explanation of my non-action in that matter.

We are a little embarrassed by the Secretary's report not being here. I had supposed he had made up a list of papers to be read at this meeting, but if he has, it has not come to hand, and I think it is best now for the Secretary to take down a list of the papers and of the writers who are ready to read papers at this meeting and I hope that those who have papers will announce the subject and then we shall have it on the program for to-morrow. Prof. Birge, I believe you have a paper?

Prof. Birge: I had expected to use about five or ten minutes on the subject of the "Vertical Distribution of Plants and Animals in the Inland Lakes."

Dr. Parker: The following names have been examined by your committee. We find them satisfactory and the committee is unanimous in recommending their election.

The following persons were then unanimously elected members of the Society:

Henry Russel, Detroit; Dr. W. P. Manton, Detroit; W. J. Hunsaker, Detroit; E. E. Bryant, Madison, Wis.; Prof. E. A. Birge, Madison, Wis.; Currie G. Bell, Bayfield, Wis.; Dr. A. W. Hoyt, 243 Wabash avenue, Chicago, Ill.; Geo. B. Davis, Utica, Mich.; W. J. O'Brien, South Bend, Neb.; Henry Sykes, Bayfield, Wis.

On motion of Mr. Dale, Mr. Fred. Mather was elected a life member of the American Fisheries Society.

Dr. Parker: I would like to ask if there is such a provision as that in the constitution?

The Chair: There is.

Dr. Parker: What does it carry with it?

The Chair: It carries with it the remission of dues. That will be covered by making him an honorary member.

Dr. Parker: What is the standing of such a member? I would like to have Mr. Mather have a voice in the Society.

The Chair: There is no reference to that in the constitution whatever, but it has been the custom to elect persons honorary members and that implies they are on the same footing as to participation in the proceedings as active members.

Mr. Dale: I move that a committee be appointed to make some recognition of the death of members of the Society and to report to-morrow morning.

The motion was seconded and unanimously adopted.

Dr. Parker: I move that a committee of three be appointed to select and recommend to the Society a suitable place for our next meeting.

The motion was seconded and unanimously adopted.

The Chair: I will appoint on the committee to take cognizance of the death of members Mr. Dale, Dr. Parker and Mr. H. W. Davis.

I will announce the committee to select the place of next meeting in the morning.

Mr. Peabody: I move that a committee of five be appointed on nomination of candidates for officers of the American Fisheries Society for the ensuing year, to report at to-morrow's session.

The motion was seconded and unanimously adopted.

A letter from the Treasurer, Mr. L. D. Huntington, was then read regretting his enforced absence from the meeting on account of illness in his family.

Letters of regret at not being able to be present at the meeting were read from H. B. Mansfield, Dr. Bushrod W. James, Bernard L. Douredore, A. N. Cheney and others.

The Chair: If you are ready I think we will have the report of the Treasurer read. The Acting Treasurer will read the report.

The report was as follows:

TREASURER'S REPORT FOR YEAR 1896.

L. D. Huntington, Treasurer, in account with American Fisheries Society:

Dr.

June 20, 1896, to balance of year 1895, received from F. J. Amsden	$141 32		
June 20, 1896, dues collected by and received from same	69 00		
		$210 32	
June 15, 1897, from dues collected for the year 1896 and for years prior thereto		372 00	
			$582 32

Cr.

July 3, 1896, T. H. Bean, late Secretary	$ 5 61
July 3, 1896, Humphrey, printing and stationery	6 00
July 3, 1896, T. E. Crossman, stenographer	41 00
July 23, 1896, Glens Falls Printing Co., printing and stationery	21 75
July 23, 1896, A. N. Cheney, Secretary	2 69
July, typewriting circulars	1 75
August. Humphrey, printing Treasurer's receipts	1 75
August. Typewriting circulars	1 75
March. Forest and Stream, use of cut of the Hon. E. Potter	2 50
March, A. N. Cheney, Secretary	24 85

March. Glens Falls Printing Co., printing proceedings of Society....................	131 92	
Postage	11 48	
July. Humphrey, envelopes	1 50	
		254 55
June 15, 1897, balance in hands of Treasurer.		$327 77

42 New street, New York City, June 14, 1897.

To the Members of the American Fisheries Society:

Gentlemen—I find from the Treasurer's books that it has been the custom of late years for the Treasurer to present at the annual meeting of the society a statement with balance, etc., but not a correct statement for the fiscal year, for which they were made, for the reason that a considerable amount of dues for and belonging to the then succeeding year, have been collected and credited to the year previous, to which they were due and belonged. For instance, in the statement for the year 1893 there were $138 of the dues of the year 1894 collected and credited. In the statement of 1894 there was $30 of the year 1895 dues collected and credited to 1894 statement, and bills incurred and presented for that year to the amount of $156.70 not mentioned in the statement, which were paid and charged in the year 1895 statement. The statement for the year 1893 shows a balance Cr. of $67.49, whereas the actual balance for that fiscal year was Dr. $70.51, $138 credited to 1893 were from dues of and belonging to 1894. The balance as shown for the year 1894 was Cr. $80.65, whereas the figures on the Treasurer's book for the fiscal year 1894 showed a balance Dr. of $66.29. The balance as shown by the statement for 1895 was Cr. $141.32, while the figures for the fiscal year of 1895 showed a balance of $328.02, the balance for June, 1894, having received the benefit of $186.70 belonging to the fiscal year of 1895. The statement herewith presented is for the fiscal year 1896; the receipts over expenditures being $186.45, which, added to the balance with the Treasurer at the commencement of the year of $141.32, leaves the actual balance of $327.77 now in the treasury.

Immediately after having been elected president of the society, June 12, 1895, I made an examination of the list of members as then of record on the Treasurer's book with their respective payment of dues, and took a verified copy of same; and with the assistance of Dr. Tarleton H. Bean, the then Secretary of the Society, we on several dates during the year 1895 prepared circulars and mailed a copy of same to all members then in arrears for dues, requesting prompt remittance of same to the then Treasurer, F. J. Amsden. Since May 20, 1896, when I was chosen Treasurer of the Society, I have at various times prepared and mailed four similar circulars to those who were in arrears at the dates of sending same. I attach hereto copies of the seven circulars above referred to. The results of the circulars so sent, as well as of numerous letters and personal requests are condensed in the tabulated statement herewith attached. This statement accounts only for the 276 names that were taken from the list of members as of record on the Treasurer's book June, 1895; there having been 22 members elected in the year 1895, one of whom has since resigned. One claims that he is not now a member and one requests his name dropped from the list. There were fourteen members elected in 1896 and there are at the present time of record on the Treasurer's book agreeable to the provisions of the constitution, with dues generally paid to date about 145 members.

The amount of dues collected in 1895 was $507, $354 being for the year 1895, $147 for dues of previous year, and $6 for dues of 1896. The amount of dues collected in the year 1896 was $441, $354 being for 1896 dues, and for dues of previous years, $87. Allow me to assure you that for two years last past, one year as President and one year as Treasurer, I have used my best efforts to collect all arrearages of dues and secure a correct list of members, with results as stated.

Yours truly,

L. D. HUNTINGTON,

Treasurer.

In addition to the foregoing the Treasurer announced that the following named persons had paid all outstanding dues and had presented their resignations:

A. Mitchell, C. H. Orvis, Dr. Bashford Dean, W. C. Clark, J. A. Loring, S. R. Stone, H. D. Dean.

On motion of Mr. Dickerson the resignations were accepted.

Mr. Dickerson: I move that the report of the Treasurer be accepted, and an auditing committee of three be appointed to audit his accounts.

The motion was seconded and unanimously adopted.

The Chair: I will appoint as auditing committee Mr. Peabody, Mr. W. H. Davis and Mr. F. N. Clark.

I desire to propose the name of Senator J. L. Preston, of Lapeer, Michigan, as a member of this Society, and the name will be referred to the committee without further order and they will report at once.

The membership committee, after a brief session, reported unanimously in favor of the election of Mr. Preston and he was duly elected a member of the Association.

The Chair: I want to say a word in connection with the Treasurer's report. I am satisfied it has been a great disappointment to him not to be present. He is a devoted member of the Society, and I have had long enough experience with the Society to know that he has made a most efficient Treasurer. He has looked after the dues, he has been very careful, and his report shows we are in very fair financial condition, and it is largely owing to his efforts that it is so. I regret as much as he does that he is not here.

The name of William Osborn, of Duluth, Minnesota, was proposed by Mr. Tomlin as a member of the Society.

The committee on membership reported in favor of Mr. Osborn, and he was duly elected.

Mr. Gunckel: I desire to say a few words on the subject of which a committee has been appointed. I had a conference with Mr. Huntington before I left New York last year, and since then I have had correspondence with President McKinley and have had a conversation with him touching the subject, and he most heartily endorses anything this Society may recommend touching the protection of fish not only upon the Atlantic and Pacific coasts, but in all the inland lakes, and he assured me he would give it his personal attention. I presume after the Dingley bill has passed he will do so.

The Chair: I desire to say a few words with reference to the printed proceedings of last year. The stenographer's report was, to say the least, a very poor one, and more care should be taken in the editing of the report. I myself opposed the return of the papers to authors after they were once in the hands of the Secretary, and made a motion by which the Secretary was authorized to retain in his possession such papers as were read at the meeting. The reason for that was that if the papers were returned to the writers, through the multiplicity of their own affairs they forget to return them to the Secretary and thus delayed the report. But my expectation was that they would have an opportunity to read and correct any extemporaneous remarks that were made. I speak for no one but myself, but there are certain things in the report, of things I said that would lead one to think that the entertainment had been too much for me. The secretary acted, perhaps, as best he could, but I dislike to be misquoted in what I say, or have senseless language imputed to me because of the inefficiency of the man who took it down. Our reports go out, not only to our own members, but they go all over the country and some go abroad, and the greatest care should be taken in their publication. It is a garbled report, so far as my own remarks were concerned at any rate, and it is too bad it should be so. A great deal of care should be taken in editing the report, particularly the discussions. Sometimes a man does not express what he means, but if he does he should be reported correctly.

Mr. Gunckle: I received several letters during the year on that same subject from members who attended the last meeting in New York, calling my attention to the remarks that they had made relating to arguments on some very important subjects, and it seems they were just the reverse of what they intended, and they wrote me that they did not think they would argue any more on any subject.

The Chair: That is it precisely.

Mr. Gunckle: And then also I noticed where they surely have misquoted, particularly the paper I read last year. There is no excuse for mistakes where you have it in black and white before you. Neither is there any excuse for having the report delayed so long as it was last year. I cannot see why this Society cannot afford to have a capable stenographer and have everything complete and let the Secretary select for publication just the things that are necessary for the advancement of the Society.

The Chair: The long delay in getting out the report has become proverbial year after year, and it does seem as if the report of this year could be gotten out promptly. If there is any value in it, it should be had in a reasonable time after the meeting.

Mr. Gunckle: Don't you think it would be well for members who submit the papers to be allowed the privilege of reading their own proof?

Mr. Dickerson: It should be sent to them in galley proof.

The Chair: And I think the Secretary, unless he receives a return of corrected proof in reasonable time should correct it according to his own judgment, and publish the report and not delay the work on account of the delinquencies of members.

Mr. Gunckle: I understand that Dr. Bean, who read a foreign paper last year, was in Europe and the Secretary had to send it over there to be corrected. I would also suggest that there be some provision made whereby the subjects of papers will be taken care of better. Now, last year in New York quite a number of gentlemen were present, and they did not report they would read papers, from the fact it takes up too much time and there is no inducement for a member to read his own paper except for the discussions that it arouses. I think there should be a provision requiring that just so many papers should be read, say five or ten, instead of depending on voluntary papers. How this should be done I will let the experienced men suggest.

Mr. Clark: It has always occurred to me that the plan suggested would be a good one; that either the officers or a committee should be appointed to arrange a plan for papers to be submitted by those interested in different subjects, papers on fish cultural matter by fish culturists, and scientific papers by scientists, and so on through, so that we would know a little something of what we are going to have. I think there should be some program made out so that we would know we would have those papers.

The Chair: I have not received any communication from the Secretary, so I cannot say how far he has gone in this matter, but I know he asked members a month ago for the titles of papers that were to be read, so I presume likely he intended to get out some sort of a program, but it has not arrived for some cause or other. It would be advisable to have a program issued in advance of the session.

Mr. Peabody: I think Mr. Clark's idea that a committee be appointed or the officers asked to solicit articles from men who are specially fitted to write articles on certain subjects is good. I quite agree with him. It seems to me, in order to be enduring we should take steps to that end. This should be a business organization. Although a certain amount of pleasure should be attached to it there should be great care exercised not to have pleasure dominate too much. Two or three days ought to be profitably spent, a good share of the days, in the discussion of papers on subjects to advance fish culture.

The Chair: I desire to say in this connection that the president took it upon himself to address several gentlemen who he believed were able and disposed to give this Society papers on some interesting theme. Among those gentlemen were Prof. Birge, who is present and expects to read a paper, and Prof. Reighard, of the University of Michigan, who will be here with a paper of interest to-morrow. He wrote to me asking me about when his paper would be due. I fancy he is a very busy man these days, and has to husband his time, but there is no doubt he will be here. I also wrote to Prof. S. A. Forbes, of the Natural History Observatory of Illinois, who promised us a paper and intended to be here personally and read it, but on Friday last I received a communication from him saying that the legislature had laid an additional burden upon him in his work and he had another engagement which would prevent him from being here altogether, and so we are deprived of his paper. I think the suggestion is a very good one and it may crystallize perhaps into a proposition for a committee to consider the matter and report to-morrow, and then the body can act upon it as they see fit.

On motion an adjournment was then had until next day at 9 o'clock.

SECOND DAY'S PROCEEDINGS.

Friday, June 18, 1897, 9 a. m.

Chairman Whitaker: The Society will come to order. I was authorized to appoint two committees yesterday, and I will do it now, so that they can get together and confer during the course of the morning and report here at their convenience. The committee on place of meeting will be Mr. H. W. Davis, Mr. Dale and Mr. Bower.

The committee on nominations will be Mr. Peabody, Mr. Dickerson, Mr. Clark, Mr. Preston and Mr. Gunckle.

The committee on auditing the report of the Treasurer is now prepared to report. We will listen to the report.

Mr. Peabody: As chairman of the committee I would report we have found the Treasurer's accounts correct and so report them and recommend the adoption of the report.

The motion was duly seconded and the report was unanimously adopted.

Chairman Whitaker: Since the close of yesterday's meeting the report of the Secretary has come to hand, and the Secretary pro tem will read it.

The report was then read as follows:

Glens Falls, N. Y., June 14, 1897.

American Fisheries Society:

Gentlemen—I have the honor to present a brief statement of my duties as Recording Secretary of this Society.

Two years ago a resolution was passed by the Society providing that the transactions should be printed within sixty days after the Annual Meeting, and last year for reasons given by Dr. Bean in his report it was impossible to comply with the resolution. Upon adjournment of the Society last year I sought bids for printing the transactions and received two of $1.35 and $1.34 per page, both New York printers, in which place former transactions have been printed. Later, the first quoted bidder reduced his bid to $1.20 per page. It was not until the latter part of October that the Treasurer was able to furnish the list of members, etc., and a week later he sent in some corrections. I know, from my own duties allied to that of preparing a membership list, how difficult it is to impress upon members the necessity for haste in the matter, and the Treasurer informs me that he used all diligence in correcting the list of members. In the meantime I had sought bids outside of New York City for printing the transactions, and received from the Glens Falls Printing Company a bid of 84 cents per page, which I accepted. The stenographic notes were sent to me in such a form, with so many blanks to fill, that it was the work of a number of days to prepare them for the printer, and even then I regret to say errors occurred. It was my idea that the proof sheets of the papers read should be submitted to the writers for correction; but, through a misunderstanding of my letter on that subject to the President, it was not done. The printed transactions were received the evening of March 4, and the same evening I mailed copies to all active members, and on March 5, mailed the remainder to honorary and corresponding members.

I have had a great many applications from those who are not members for copies of the transactions, and these I have filled so far as I could. Dr. Bean turned over to me a considerable number of copies of transactions for the year 1895, and I found in Albany a large number of copies of transactions for 1894, left there by a former Secretary. When these have been asked for I have mailed them to those who applied after consulting with ex-Secretary Bean and the President. A number of public libraries have applied for complete sets of the transactions, but I believe there are not half a dozen in existence. My own set, after years of earnest searching after missing copies, is still lacking a few years.

I would suggest that some formal action be taken by the Society upon the matter of furnishing copies of the transactions to those who are not members.

At the last meeting a resolution was passed restoring to the transactions a list of deceased members, and, after considerable correspondence I was able to secure a list of 24 names. In this matter I have received almost no assistance from the members in reply to my letters, and the list is made up chiefly from my own knowledge, after reading the lists of members in such copies of the proceedings as I have. I have found that the following names should have been added: Charles B. Evarts, George E. Ward, John A. Greusebach, Roland Redmond, B. L. Swan, Jr., Benjamin West and J. J. O'Connor.

It is earnestly requested that the members of the Society co-operate in securing a complete list of deceased members.

There may be some of the new members who are unaware that the American Fisheries Society was originally termed the American Fish Cultural Association. At that time the Association had a seal consisting of three crossed fishes, with the title of the Association inside of a circle. I would recommend that action be taken to restore this seal with the amended title of the Society as now recognized.

The address of T. H. Palmer, a member, is unknown to the Treasurer or Secretary.

The copies of the transactions mailed to Prof. B. Ben, Germany, and Don Francisco Garcia Sola, Spain, have been returned uncalled for, and I have received corrections in addresses of other corresponding members, and of a few active members whose addresses have been changed since the transactions were printed.

I must repeat what my predecessor had said, that the work of the Recording Secretary cannot be efficiently done without the assistance and co-operation of other members. There is considerable correspondence connected with the office, and the work of preparing the transactions is not slight, but it is cheerfully rendered; and if members will assist in furnishing proper addresses and missing records, the proceedings can be made perfect and complete. I would suggest that, for convenience of the printer and Secretary, the stenographic reports of discussions following the reading of papers be made a part of the paper, and each paper with the discussion be complete in itself and not a part of the routine business.

On March 27 I sent out the first notice of the annual meeting for this year, requesting members to send to the Secretary titles of papers to be read.

On May 27 I sent out a second notice to all members, giving time and place of meeting in Detroit, with a summary of the program prepared by the local committee for the entertainment of the Society, and again asking that titles of papers should be sent in promptly.

There are on hand several hundred copies of the transactions of the Society for the years 1894, 1895 and 1896.

Respectfully,

A. NELSON CHENEY,

Recording Secretary.

Chairman Whitaker: There are certain suggestions made in the report, and it seems to me it should be referred to a committee, the suggestions be considered by them and reported upon. The Chair will entertain a motion for the appointment of such committee if desired.

Mr. Clark: I move that such a committee be appointed, although I do not wish to be appointed on that committee.

The motion was seconded and adopted unanimously.

Chairman Whitaker: I will appoint as such committee Mr. Bryant, Mr. Dale and Mr. Bell, and the report of the Secretary will be turned over to that committee and they can consider and report on the recommendations therein contained.

The following names were then presented in a letter from Mr. Cheney, the Secretary, for election as corresponding members of the Society:

J. J. Armistead, Dumfries, Scotland; S. Jaffe, Osnabruck, Germany; Wm. Seinor, Fishing Editor, "London Field."

On motion of Mr. Titcomb, duly seconded, the gentlemen named were unanimously elected.

Mr. Titcomb: For the interest of those who like good literature on these subjects I would like to suggest that Mr. J. J. Armistead is the editor of "An Angler's Paradise," which is a most interesting book on that and kindred subjects.

Chairman Whitaker: I quite agree with you, I think it is the most interesting book that has appeared on fish culture in a great many years.

There is also a letter to the Secretary from Dr. James, whom we all know to be an active member of this Society and a gentleman who always contributes some paper, notifying the Secretary, that on account of the meeting of another body to which he belongs holding its meeting at this time, and being in charge of two of its sections, he is unable tobe here and forwards a paper.

Mr. Clark: I would like to ask if the names presented in that letter, for membership, are supposed to be in the hands of the committee on membership?

Chairman Whitaker: They are in the committee's hands, and there are two or three other names that will be referred to the committee. I will read these communications because the Secretary is busy.

A letter from Mr. Cheney was read proposing for membership the following: Col. J. J. Brice, U. S. Fish Commissioner; C. C. Wood, Plymouth, Mass.; H. Seymour Bulkley, Odessa, Mass.

Mr. Stranahan proposed the name of J. C. Fox, of Put-in-Bay, Ohio, for membership.

The applications were referred to the committee on membership.

Mr. C. B. Reynolds, of New York, tendered his resignation, which, on motion duly made, was accepted.

Letters from the Chamber of Commerce, from the Mayor and Common Council of Nashville, Tenn., from the Governor of Tennessee, the Director-General of the Tennessee Centennial Exposition and the "American," "The Banner" and the "Sun" newspapers of Nashville, were read inviting the Society to attend the Exposition in that city.

On motion duly seconded the invitations were accepted and placed on file.

Mr. Clark: The committee on membership reported favorably on the names presented for membership, Hon. J. J. Brice, of Washington; C. C. Wood, of Plymouth, Mass.; H. C. M. Bulkley, of Odessa, N. Y., and J. C. Fox, of Ohio.

Mr. Peabody: Is it not customary to have the United States Fish Commissioner elected as an honorary member.

Chairman Whitaker: No, he is elected as an active member.

You have heard the report of the committee that these gentlemen be elected to active membership; what will you do with the report?

On motion, duly seconded, the above named candidates were elected members.

Chairman Whitaker: I think, gentlemen, there are no other committees to report and there is no other routine business. We will now proceed to the reading of papers and the discussions. It is customary after each paper is read to take them up and discuss them. The first paper will be a paper on the "Vertical Distribution of the Lower Plants and Animals in the Inland Lakes," by Prof. E. A. Birge, of Wisconsin.

VERTICAL DISTRIBUTION OF THE LOWER PLANTS AND ANIMALS IN THE INLAND LAKES.

By PROF. E. A. BIRGE, of Wisconsin.

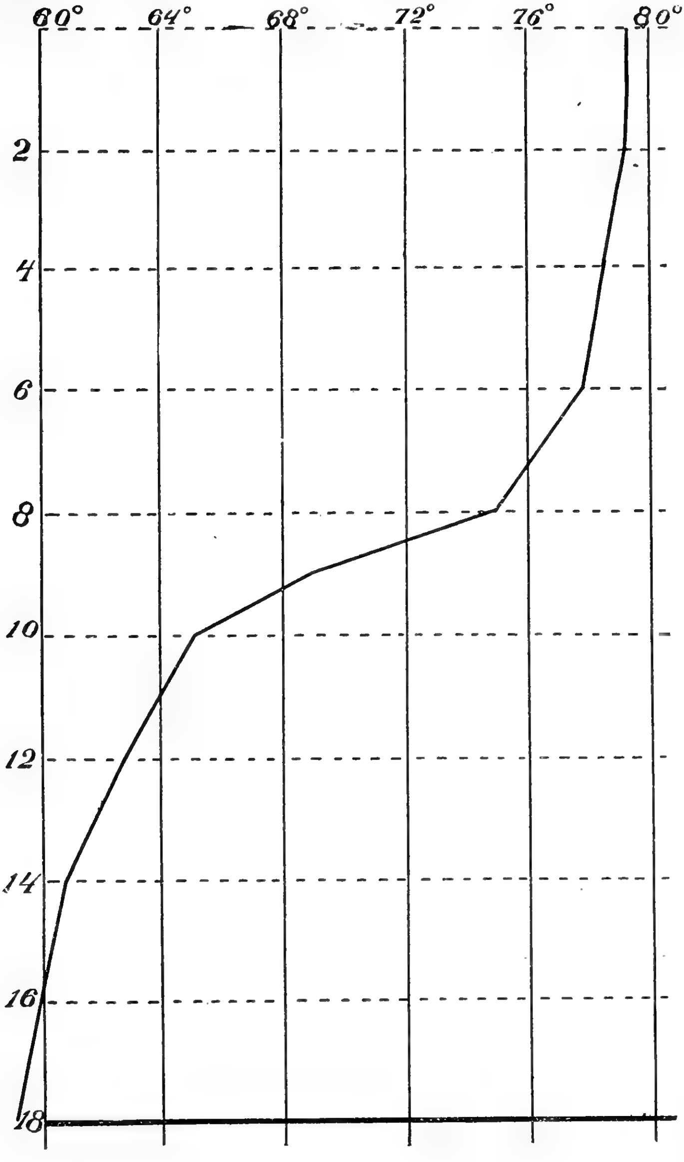
Prof. Birge: I did not expect to be called upon first and have not much to say. During the past three years I have been engaged in studying the history both of the distribution throughout the year and the vertical distribution of the small crustacea of the lake which immediately adjoins the University of Wisconsin, Lake Mendota. This lake is about six miles in length and from three to four miles in width, and, as you see, a rather large sheet of water as inland lakes go. It is a lake of some 85 feet in greatest depth, the greater portion of the lake being over 50 feet in depth. At a distance of about a quarter of a mile from the shore we reach a depth of about 60 feet and from that point on to the middle of the lake the increase in depth is quite slow, so that the greater portion of the lake is a plain varying only ten or fifteen feet from level.

In studying the vertical distribution of these animals I employed a kind of a dredge so constructed that it could be lowered to a given depth, opened under the water, and then raised through any desired distance and closed again when it had reached the proper height. In that way it was possible to obtain the living plants and animals between certain depths. It is opened at the bottom, is then raised, say ten feet, is then closed and brought to the top and the contents taken out. In that way it is possible to get the plants and animals of the lakes from each stratum.

It is not my intention to go into the details of the distribution, but to call attention to one point only which seems to me to have some practical bearing. In order to explain that, it is necessary to speak of the temperature of these lakes. As we all know, the temperature of the bottom of our great lakes or inland lakes is decidedly lower than the temperature at the surface. While in Lake Mendota, for example, the temperature at the surface during the summer is 75° or even 80° on the hottest days, the temperature at the bottom is quite constant, somewhere from 50 to 60 degrees, varying with the different seasons, at a depth anywhere from 50 to 80 feet. The decline in temperature from the surface to the bottom is by no means a regular one. During the spring, the period when the lake is warming up, the decline of temperature from the surface to the bottom is more or less uniform. But when the season has advanced, from about the 1st of July, in Lake Mendota, to the latter part of September, we find a peculiar distribution of temperature. The upper water of the lake, varying from about 20 feet in thickness to some 45 feet, is very nearly uniform in temperature. One may say, speaking roughly, that in the early morning, before the sun has had any effect, the upper stratum of the lake is practically uniform in temperature, falling, perhaps, in this distance of 20 to 40 feet, 1 or 2 or perhaps 3 degrees Fahrenheit.

Immediately under this stratum there comes a thin layer in which the temperature falls with great rapidity, sometimes falling as much as 10 degrees Fahrenheit in a meter, at other times falling less rapidly than that. But there is always a zone immediately below the warm water in which the temperature falls very rapidly and below which the falling of the temperature is quite uniform and slow until the bottom is reached. This little chart which I have had drawn to go with the paper will illustrate this.

This diagram shows the condition of temperature on August 12, 1896. In the diagram the horizontal lines represent depth in meters and the vertical lines temperature in degrees Fahrenheit. You will see that at the surface the temperature is about 79 and at the bottom a little above 59—a difference of 20 degrees between the top and bottom. But the line of temperature shows that the rapidity of the fall in temperature is very different at different depths. From the surface to 6 meters there is very little fall, somewhat more in the next two meters, while there is a drop of nearly 10 degrees from 8 to 10 meters, and a fall of only about 6 degrees in the lower 8 meters. It is plain that nearly one-half of the difference in temperature between the top and the bottom of the lake comes in the two meters from 8 to 10. The effect of this is that the lake becomes divided into two parts, horizontally. There is what you may call a warm lake on the surface from 20 to 30 feet thick, or of even greater thickness than that. This lake is subjected to the action of the winds and the currents keep the water stirred up, so that the water may be brought to the surface by the action of the wind. Below lies another lake, say from 20 to 30 feet below the surface and extending to the bottom, which is entirely undisturbed by the wind, in which the temperature



This Figure shows the temperature of the water of Lake Mendota on August 12, 1896. The vertical lines indicate temperature and the horizontal lines indicate depth in meters. For general purposes 3 meters may be reckoned as 10 feet. The heavy line going obliquely across the diagram indicates the temperature at the different depths, being 79° and a fraction at the surface, about 78° at 6 meters (20 feet), 65° at 10 meters, etc. On this date there were only 5,500 crustacea per square meter of surface between 10 and 18 meters, 24,000 between 9 and 10 meters, and 66,000 between 8 and 9 meters.

does not change except in connection with the zone where the warmth is working its way down very slowly as the season advances through the late summer and early fall. During July the zone of rapid descent of temperature—the bottom of the upper and warm lake—lies from 25 to 30 feet below the surface. In August the warm water may become as much as 40 or more feet thick and in late September the entire mass of water becomes mingled and uniform in temperature.

During the summer season, then, we have a warm lake on top subjected to the action of the winds, and a cold lake on which the wind has no influence. As a result we find that the bottom of the lake during the hot months of the year and during the months when most vegetation is found in all our lakes, is entirely cut off from immediate access to the air, and, furthermore, everything that goes down there stays there. In Lake Mendota the water down in the lake becomes decidedly foul, not as foul as in some lakes on record, but as the minute plants and animals of the upper waters die and sink, there results an accumulation of decomposing matter in the lower water, and the deeper or cold water becomes distinctly foul. It smells like rotten eggs, to put it plainly, and it tastes like sulphur water, evidently from compounds arising from the decomposition of these small plants and animals. As a result of this accumulation of decomposing matter the plants and animals of the lake which are the ultimate food supply of the open water, are unable to live in the lower water of the lake, and during the months of July and August and the greater part of September all of the plankton life of the lake is confined to the upper water. You may say that 95 per cent. and more of the crustacea, and the proportion of plants would not be essentially different from that, are found in the warm water above, and less than 5 per cent are found in the cold waterin the lower part of the lake. It makes no difference whether you go to the shallower part of the lake or the deeper part. Where the lake is say 85 feet in depth there may be 50 feet of this water with practically nothing in it with the exception of a very few small animals and many of these are in a weak and dying condition. Apparently you get none of the smaller forms, except those that have become weak or are dying or have got stuck in moulting their shells, and in one manner or another become incapacitated and sink down there toward the bottom.

The bottom of the warm water forms the lower limit of the plankton life and this life closely follows that limit as the warm water gradually increases in thickness during the summer and early autumn—in late August and September.

Chairman Whitaker: To the bottom?

Professor Birge: Towards the bottom. In October you may say in a general way the crustacea and the plants are distributed about uniformly through the whole depth of the water. I can illustrate the distribution of the animalcules on certain dates when they were accurately determined. For instance, figuring the crustacea on this particular day, August 12, 1896, below 10 meters there were in a column of water a meter in area, and 8 meters in depth, 5,500 crustacea. In the lower part of the warm water, in a cubic meter of warm water, there were 24,000. There were four times as many crustacea in the bottom meter of the warm water as there were in the whole 8 meters that lay below. In the next meter above there were 66,000 crustacea, so that the difference is simply enormous. On another date there were found 3,600 crustacea, from 11 to 18 meters, while in the next meter above (10 to 11) there were 20,000, and in the meter above, 43,000 crustacea in a single cubic meter. So that while in the 7 meters below the warm water there were only about 500 crustacea per cubic meter, in a single cubic meter above there were 20,000, and in the next above that twice as many more, over 40,000.

Now you can see the bearing of this. There are some insect larvae, not very numerous, that go right up and down through this stratum, and there are mollusks, Cyclas, that we find in the mud at the bottom. But you can see at once that the supply of food for fish in this bottom water under this condition of things must be extraordinarily small. Now, I imagine that one thing which all fishermen tell us, that the white fish in Lake Mendota congregate during the summer in the region of the springs, is possibly true (although I have never been able to locate those springs). It seems reasonably clear that if they spread themselves around the lake they must get short picking in the matter of food, because very little food is there. And so, again, it is possible that this scarcity of food is one of the causes which brings about the death in our region of a considerable number of white fish towards the latter part of the summer.

The other point of practical importance is this: This accumulation of decomposing matter in the lower part of the lake may not be without a direct effect on the fish life that is present. Just about thirteen years ago, in 1884, we had in Lake Mendota a very great mortality among the perch. There must have, on a moderate estimate, from five to eight million of perch died in the lake during the summer. You remember it very well, Gen. Bryant? They washed up there on the shore. The street superintendent buried from the city bank of Lake Mendota over 200 tons of these dead perch that washed up there, and that includes, perhaps, only three miles of the front of the lake, which must be some twenty miles in circumference, and they were washed up like that all around the edge of the lake.

You will find a report of this by Professor Forbes, who came up there to investigate the cause of the fish dying. He was sent there by the Fish Commissioner, and came there in the latter part of the mortality, and he found nothing as to the cause. I studied it all through the season, but was unable to discover any cause.

Professor Forbes' report is found in the eighth volume of the Bulletins of the U. S. Fish Commission, 1887.

Chairman Whitaker: Were there any physical appearances in the fish to indicate anything in the way of parasites?

Professor Birge: You could see nothing; no, there was nothing in the way of parasites. You would find fish swimming around the surface. On a calm morning you could look out over the lake and you could see the lake spotted with these fish as far as the eye could reach; many of them dead, some of them feeble and wriggling around the surface. If you picked up one of those fish the blood from that slight pressure would simply strain out over your hands, and on opening one, the intestines seemed to be drained of blood, it was all choked in their gills. If you examined them, you would find practically that all the blood of the body was in the gills and kidney. Now, I saw nothing to account for this. I studied the blood vessels and cut sections as well as I knew how, and I was still unable to find anything. Professor Forbes also worked at it and was unable to discover anything.

Within the last two or three years, since finding this accumulation of decomposing matter in the bottom water, it has occurred as a possibility, but I would not give it as anything more than a possibility, that there may be poisonous compounds in the water which might be the cause of such epidemics. The stomachs of the fish were nearly empty, though sometimes they had insect larva in their stomachs, the regular food on which they lived, and there was nothing to apparently cause this epidemic.

Chairman Whitaker: Then their condition did not show that it was from the effect of starvation? They had not gotten into this barren zone of water in the bottom and starved to death?

Professor Birge: No, I saw no reason to believe that. The fish were reasonably fat, and food was in their stomachs.

Mr. Clark: Were any other fish affected besides the perch?

Professor Birge: The whitefish also. They die every year in certain numbers. I have never been able to get hold of a dying whitefish to see whether its gills show the same symptoms. Many more died this year than ever before.

Chairman Whitaker: Have there been any recent physical changes in the character of the lake?

Professor Birge: No.

Chairman Whitaker: Have there been any artificial changes that would tend to contaminate the water at all?

Professor Birge: No. At that time, I think, there was no sewerage discharged into the lake, and the lake, except for having a border of inhabitants, was in the same condition it had been since the dam was put in there 30 or 40 years ago.

Chairman Whitaker: Has this great mortality been of frequent occurrence?

Professor Birge: Never before, never since.

Mr. Nevin: Last year in Barron County, Wis., the whitefish died in great numbers.

Professor Birge: Those epidemics are only occasional. We do not often get a chance to study them, and it seems to me it would be well worth while, if one could get an opportunity to study it with reference to the condition of the bottom water of the lake, to see whether, under some exceptional conditions the bottom of the lake does not get exceptionally foul and thus accumulate poisonous material which may cause directly the death of these fish. I ought to add, however, that the Mendota epidemic ceased about the middle of August, while the lower water must have been still foul.

Mr. Clark: You did not examine to see if it affected the animalcules of the lake?

Professor Birge: At that time I was not studying them, but it is quite evident that the crustacea do not live in that water. The insect larvae will, as you know, stand almost anything in the way of foul water. The rotifers do not go down into the stagnant water.

Chairman Whitaker: Over how long a period of time did your observations extend?

Professor Birge: A space of two years.

Chairman Whitaker: I meant as to season?

Professor Birge: I have gone right through the summer and winter. I began in July, 1894, and went along from that time, making more numerous experiments during the summer. Taking the year through, nearly every other day, during the two years.

Mr. Tomlin: Was it not very warm weather during all this time of the epidemic?

Professor Birge: Not extremely hot. We were not doing any work on temperatures at that time, but whether the season is very hot or very cold makes very little difference in the temperature of the deep water. The temperature of the deep water depends a good deal more on the concurrence of the warm weather and alternate calms and high winds in the early spring than it does on anything that happens in the summer. After this middle zone is established the bottom water does not get affected at all by warm weather.

Chairman Whitaker: Does it not later in the season?

Professor Birge: Not until September, and then the surface water has cooled gradually before the bottom water gets affected. The temperature of the bottom water rises rapidly before the first of June, and then keeps very nearly uniform until late in September, when it goes up pretty rapidly in connection with the mixing of the temperatures by the wind, as the temperature on the surface of the water falls.

Mr. Stranahan: Was this mortality confined to the portion of the lake over the deep water?

Professor Birge: That is hard to answer specifically. These points all came to me years after the affair was over, and I did not take all the observations then that I would now, but it was generally true that the dying fish were out in the open lake. As I recollect it, I do not recall seeing any dying fish close to the shore, unless there was a strong wind bringing them in, and when you saw those fish they came from the surface out in the open lake, not from near the shore.

Mr. Titcomb: I would like to inquire how the lake is supplied with water. Is it by springs?

Professor Birge: There is a small creek, but a good deal more water comes in from large springs at the part of the lake furthest removed from the city.

Mr. Titcomb: In getting at the temperatures, of course the waters nearest those springs would remain coolest the year round, have an even temperature, would it not?

Professor Birge: I have done very little work at that end of the lake. The temperature of the creek during winter and the bottom temperature of the lake, falls below the temperature of springs. It falls to 35 or 36 degrees at the bottom and it does not rise anywhere until after the ice goes out in the spring, so that this inflow of water is not sufficient to raise the bottom temperature, through, say, three and a half months of the winter.

Mr. Titcomb: I was making inquiries, because I have been taking observations of temperatures in the trout lakes of Vermont, and we have lakes fed there largely by springs, and the temperature remains very even, within 20 feet below the surface. You go 20 feet below the surface and you will get a temperature of 40 to 46 the year around. The lake is about 1,500 feet across and two miles long.

Professor Birge: The bottom temperature differs in different inland lakes more with reference to the area than in respect to the direct depth. In Oconomowoc Lake, which is perhaps a mile or a mile and a half long, the bottom temperature is about as you get it in Vermont, about 43 to 44 degrees, at 60 feet in depth, while in Lake Mendota, which has a greater area, the bottom temperature is 60 degrees.

This peculiarity of the foulness of the bottom water is true only of lakes where there is a rich plankton. The other lakes of which I speak, Oconomowoc Lake and Pine Lake, are typically plankton poor lakes, where there is not one-twentieth as much of vegetable life as in Lake Mendota. In both those lakes crustacea go nearly or quite to the bottom. The foulness of the water is from the quantity of material dropped down there from the surface.

Mr. Titcomb: With reference to epidemics, I will say a word about our experience in Vermont. We have not had an opportunity to study it there, but the Professor's remarks upon that thought are very interesting to me. We have one lake inhabited by trout and bullheads—the bullheads were evidently artificially introduced. It is not a natural pond for them, but the bullheads throve there for years, until last year there was an epidemic. No trout died. The bullheads in that lake came to the surface and lined the shore in the same way you describe, only in less quantities. In another lake in Vermont we had an epidemic among the perch in the same way you describe, although not in any such quantities, and the third time, three years ago, we had still another epidemic among bullheads in a sort of dead creek which is tributary to Lake Champlain. The bullheads in Lake Champlain, in clear waters, are delicious food fish. We call them the "poor man's fish" there, because they catch them all the time through the summer, night and day, but in this dead creek, one of those sluggish waters, they taste of the dirt and are foul. We never have investigated the causes of these epidemics. In fact, in the case of a trout pond, where an epidemic occurred, it is the source of water supply for quite a large town, and the corporation officials are very careful to remove those fish as rapidly as possible, to keep the people of the town ignorant of the condition. So, I did not get hold of it until afterwards, but if it is a question of foul water, it seems to me it endangers the sanitary condition of the water supply of that town.

Professor Birge: That is not necessarily true. If you will look into the reports of the Massachusetts Water Commissioners, you will find that they say the water supply must be taken from the upper surface, that the lower water will be unfit to drink in later summer.

Mr. Titcomb: There is a question that comes up in connection with my investigations. I always thought, for the purpose of getting a constant water supply of large volume and even temperature, you must take the water from a large lake to which trout, for instance, are indigenous, and taking it from the lower depth or stratum, where the water remains at a constant temperature of 48, you get a sufficient amount or sufficient volume to run a hatchery to an unlimited extent.

Professor Birge: That would depend entirely upon your lake. If you have a large supply of spring water coming in there, and the amount of vegetation in the lake is small, it may do the work perfectly well. But if the conditions are as they are in Lake Mendota, and it is a great deal worse in some other lakes as reported by the Massachusetts Water Commissioners, you can readily see you could not run a hatchery with that water. If the bottom water is pure in late August and September, it would be all right at any time of the year, but it would have to be a matter of investigation with each individual lake.

Chairman Whitaker: There are some things that have occurred to me in this connection, and I do not know but your last remarks explain it. Do you know whether this condition of affairs happens occasionally in a lake, or does it obtain in all your lakes in a measure?

Professor Birge: These temperature conditions belong to all lakes of any depth.

Chairman Whitaker: I speak with reference to the foulness of the water.

Professor Birge: It depends upon the amount of the floating plants and animals. There are various conditions in lakes in that regard. In Green Lake, in Wisconsin, which, you may know, is a lake of about the same size as Lake Mendota, though of different shape, but about 200 feet deep, at a time when the plankton vegetation is most abundant, there is not a fourth as much as there is in winter in Lake Mendota. It is not a question of bad water at all, but of the natural capacity of the lake to grow vegetation. Upon what that depends, I don't know, but there is more difference in lakes in capacity to grow vegetation of different sorts, than there is between fields to grow grass, and in lakes abounding with this vegetation the water will be foul.

Dr. Parker: Did you learn anything about the presence of female fish among those dead fish?

Professor Birge: I made no observation on that, as far as I recollect.

Dr. Parker: How was it in regard to the bullheads, Mr. Titcomb?

Mr. Titcomb: The whole lake was cleared out of the dead fish and we could not investigate it, as we did not learn of it in time. I do not think there was anything abnormal in the weather; I am sure they had spawned, as this was along in July and August, and the season was not a particularly abnormal one any way.

Chairman Whitaker: May I ask a question of you? There are some things in connection with the paper that seem to me might have a bearing on the general movement of fish from one depth to another, in relation to fish food. If I understand you right, as the season progresses, up to September and October, the conditions of temperature are reversed, the top growing cooler as it nears the fall months, and the temperature gradually rising at the bottom.

Professor Birge: That is not quite correct. The story is rather a long one. In one lake which has been investigated, that is 60 feet deep, the bottom remains of a constant temperature until November. The lake being so small the bottom temperature practically rises only a fraction of a degree until the water begins to be mixed by the influence of the winds. Of course, the area of the lake makes a very great difference in regard to the effect of winds.

Chairman Whitaker: When that change takes place in the water is it by reason of violent winds, or by changes of season, or by transmission of caloric from the top to the bottom, and when it has changed, are the bottom waters richer in plankton than the surface?

Professor Birge: Very much richer than they were, but never actually richer than the surface strata.

Chairman Whitaker: It seems to me this is a very interesting question. May that question not govern somewhat the movement of fishes? May they not find a richer field at the bottom in certain months in which to live? If they do not hibernate, but if they actually do go to the bottom and feed, may not that result from the changes nature sets up in this way?

Professor Birge: I cannot speak with knowledge of that, except with reference to the perch in Lake Mendota. They go to the bottom in winter; are caught in immense quantities in the lake in anywhere from 40 to 60 feet in depth. But the stomachs of the perch during winter are pretty nearly free from food.

Mr. Clark: Do they not go to that great depth to get a warmer temperature?

Professor Birge: They don't get a much warmer temperature at the bottom during the winter; the temperature near the bottom is near freezing—ordinarily it is between 34 and 36 degrees at the bottom. It stays there all winter, and the lake reaches a temperature within a fraction of that a very short distance below the surface, so that you see it is not very much warmer at the bottom.

Mr. Davis: Is it not possible the death of these fishes is caused more by epidemic than it is by what they live upon? Last week I was north near Baldwin, in this State, and I learned there that the trout were dying. A certain kind of trout, the brown trout, were dying in considerable quantities in one of the streams. I did not have an opportunity to see any of the dead fish, but I made arrangements to have some of them sent here to Detroit. A sort of epidemic seems to have attacked the brown trout there, but none of the rainbow or brook trout died. Now, we consider the waters of the Pere Marquette River and its branches pretty pure water, and it strikes me there must be something of an epidemic.

Professor Birge: There was evidently an epidemic here, to cause the death of several millions of the population of this lake. That was entitled to be called an epidemic, but the trouble was to find out what the cause of the epidemic was. We looked for all sorts of parasites, internally and externally, and we could not find anything significant.

Mr. Davis: I understand the brown trout up north are covered with sore spots.

Professor Birge: That would indicate they are attacked by a fungus, then.

Mr. Davis: And by the lamprey eels.

Chairman Whitaker: It is rather a singular thing, that only the brown trout should be affected.

Mr. Clark: I do not suppose there is anything remarkable about its affecting one kind of trout in a stream and not another. We found that right in our ponds. We had an epidemic at Northville over a year ago which simply depleted our ponds of brook trout. Of course, we had to look around to see what caused it. The brown trout in the same water were not affected at all. That is probably the case with this stream, it affects the brown trout and not the others.

Dr. Parker: In mentioning whitefish, you spoke about their food possibly being affected by the condition of the water at the bottom, the foulness of the water. Have you examined very closely as to the food of the whitefish?

Professor Birge: I have not at all.

Dr. Parker: I could give a little history of my connection with that a great many years ago. I found in some whitefish brought from Lake Michigan to Grand Haven, that the food in the stomach of the fish was a small bivalve not larger than a grain of sand. I was quite nonplussed at first in looking it over. I was looking for something larger in the stomach of the fish, and I examined several before it occurred to me to make use of the magnifying glass. I did so, and I found that what I supposed was sand was a very minute bivalve shell. Afterwards, in examining a fish on the Lake Superior shore, I found not only the same small shell, but I found other shell fish there, the paladina. I was quite surprised to find this and other large shells there.

Professor Birge: Didn't you find also with the bivalves the mysisina? We found them at Charlevoix, and I think that was their chief food, was it not, Mr. Post?

Mr. Post: I think so.

Dr. Parker: My examination was not very thorough, but as far as I could tell, I came to the conclusion the fish were feeding on that bivalve.

Mr. Tomlin: In connection with my duty in the neighborhood of what is called Dead Lake, Minn., from the 15th of July until about the 20th of August following, I was around on the different sides of the lake. It is about 25 miles long, running from two to nine miles wide. The bass, both the black and what we call the green bass, grow there to very large size. Three years ago this next month the black bass and the red horse, or what is commonly known up there as the sucker, were found dead in the pond, and the stench was intolerable. There was no use trying to bury them. The settlements were so few there was no possibility that anything in the shape of sewage should have caused the fish to die. I hold in my hand the report of the Western Society of Engineers, and there is a little item in that that may throw some light on the professor's subject. It says "there are tides in every pond, however small and insignificant, they are there and perceptible." The level of the lake has not undergone any variation and the depth and area of the basin remains the same. It seemed to me, while the Professor was reading this remarkably interesting paper to us, that this matter was old. The tides in such a lake as this would stir up all the deleterious matter from the bottom of the lake and thus cause the death of these fish. Whether I am right or not, I would not say, but the thought occurred to me at the time.

Professor Birge: Lake Mendota has no tide. There is no question about that, and there is no stirring up of the lake. The water below is as calm as water which is bottled up tight. I do not want to be understood as offering any general explanation of fish epidemics. I refer to this as something, so far as I know, that has never been referred to. Fish epidemics are one of the most interesting and difficult problems that fish culturists have to deal with, and while I have no doubt they are due to as many different causes as human epidemics, I brought this forward, not as a certain, but as a possible cause of the epidemic and one worthy the attention of all of us when we have a chance to study an epidemic of this sort.

Chairman Whitaker: I am very sure we are all much interested in this matter and in the remarks that have been made extempore by the professor. It is plainly evident that the professor's apology, to start with, was unnecessary. He said his paper was not written, and it seems to me very fortunate for the society that it was not written, it was more entertaining in the form in which it was given.

Wisconsin and Illinois are both working along lines which, it seems to me, are bound to be a benefit to fish culture. We have long witnessed these so-called epidemics of fish without any attempt to solve the matter. It is just about as valuable when we merely see and speculate about these things, as it is to look at an aquarium without any information as to the life and habits of fish—simply to satisfy an idle curiosity. We have got to a point where it seems to me essential that fish culturists, who are attempting to restock the waters, should be aided by scientific investigators, and that the two should work together; the scientific men settling those questions that scientific men alone can settle, by investigation. In that way we shall get at the cause of these things, and there is nothing in fish cultural experience that cannot be solved along the lines of inquiry that are being pursued in those two states to-day. I am sorry to say that while Michigan for two or three years had a good bureau of scientific inquiry, in the hands of able men, it was compelled to discontinue that work because of lack of money. It was a great mistake, but we must not quarrel with things that exist, but, if we can, correct them. It is a very gratifying thing to know there are two states that are working along these lines. Illinois has established what is called a natural history observation station. It is in the hands of a very capable man with able assistants, and there is no question but good results will follow. I congratulate Wisconsin upon having associated with its commission a man who has not only the ability, but the inclination to follow out these investigations that will certainly result in benefit to fish culture. These investigations may at present seem somewhat remote, but they are not so, and in order to get an intelligent conception of the matter, the whole range of inquiry as it is related to the different forms in water, temperatures and all those things that are naturally connected with it, these investigations must be made in order that just conclusions may be drawn.

We will now listen to a paper by Professor Reighard.

Professor Reighard: I had intended to present a review of what has been accomplished in the scientific study of the fresh waters, since the revival in that line of study; but when I came to look into the matter more carefully I found there was so little of it, and so much of that that was not of direct interest to practical fish culture, that I limited the paper to certain thoughts on the recent developments in the study of fresh waters from a scientific point of view.

SOME CHARACTERISTICS OF RECENT WORK ON THE BIOLOGY OF FRESH WATERS.

By PROF. REIGHARD.

I had intended to prepare a paper reviewing what had been accomplished in the scientific study of the biology of our fresh waters, but an attempt to carry out this purpose soon showed me that a paper so prepared would include much matter that does not especially appertain to fisheries. I shall, therefore, not attempt to carry out the original plan of giving a summary of results, but shall point out merely two lines along which advances have been made, and shall then indicate the bearing which some of this work has upon practical problems.

Perhaps the most striking feature of recent scientific work on our fresh waters has been its rapid extension within the past few years. Before 1890 scientific men, zoologists particularly, had given attention to the sea, almost to the exclusion of the fresh waters. The sea contains representatives of more animal groups than the fresh water, and it contains also a large number of forms generally considered to be primitive. To the sea, then, zoölogists have generally turned for the solution of their scientific problems. Within ten years, however, a reaction has made itself felt in the direction of the study of fresh water animals. Interest in this study finally led to the establishment by Zacharias at Plön, in North Germany, of a laboratory devoted exclusively to the study of the fresh waters. This laboratory, which has been subsidized by the German Government, was the first of its kind. Like most of the similar laboratories which have been since established, it is a purely scientific institution, whose object is to afford facilities for the solution of the problems of fresh water biology. Its founder, Dr. Zacharias, hoped that its investigations would furnish data for the solution of many of the practical problems of the fisheries, and he did not hesitate to hold forth this hope when asking for financial support. Its realization can only be a matter of time. In this connection it cannot be too forcibly pointed out that science cannot afford to serve. Her best results are obtained when she is left quite free to grow at her own gait and in her own way, and these results cannot be other than of value to the useful arts. It is a mistake to require that a scientific institution should devote itself exclusively to the solution of practical problems. Its workers should be left free to develop each in accordance with his own bent. Thus will the institution be most efficient; thus will knowledge be most rapidly widened, and thus, too, will practical problems, soonest reach their final solution. Final solution of such problems depends on fulness of knowledge, and fulness of knowledge is not to be attained by an investigation directed narrowly toward the solution of a practical problem.

The station at Plön has been followed by others in different parts of Europe. One of these, that on the Mugelersee, near Berlin, has been founded and is conducted entirely in the interest of the fisheries. Investigations have further been undertaken of Lake Constance and of Lake Geneva.

Stations have also been established in this country. That on Gull Lake, started by the University of Minnesota, was in existence for but one year. It seems to have been the first of its sort in this country, but I do not know that any results of importance have come from its establishment. The station maintained by the Michigan Fish Commission on Lake St. Clair in 1893, and on Lake Michigan in 1894, was the next in order of time. The results of its work have been embodied in five bulletins issued by the Michigan Fish Commission. In 1895 there was established by the University of Illinois a fresh water biological station, of a purely scientific character. It has now completed its second year of work, under the directorship of Professor Forbes, and several valuable papers have come from it. The unique location of this station and its excellent facilities lead us to expect much from it. In the meantime there has been established a summer station on Turkey Lake, Indiana, in connection with the University of Indiana, and several papers have already appeared from it.

A second characteristic of the work on our fresh waters has been the introduction since 1890 of exact methods. The (fresh water) biologist aims at a physiology of organisms. He desires to measure, count, and weigh the animals and plants of a given area, and to determine their food relations to one another. By such means he hopes to be able to trace continuously and quantitatively the transformations of matter from the inorganic constituents of the soil through the bodies of plant and animal and back again to the soil. The difficulties in the way of such an accomplishment are insuperable in the case of terrestrial plants and animals in a state of nature. The enumeration alone of the plants and animals of a single acre of wild land is an impossibility, and even if the task were possible, the continual changes would render it fruitless. In the ocean attempts to do quantitative work are rendered difficult by the great number of species of animals present. In the fresh water the number of species of minute animals and plants present (excluding those that live in shore or bottom) is only about eighty. When, now, it has announced that a method has been found of counting, weighing and measuring all the animals and plants occuring in a given volume of water in a lake, or occurring in the whole lake, an immense stimulus was at once afforded to the investigation of aquatic biology. The animals and plants which live upon the shores or bottom of a body of water form only a small part of all the organisms that it contains. Far heavier and bulkier than the sum of these is the sum of those minute forms that are found floating in the free water removed from the influence of shore or bottom. These forms are small and weak and are buffeted about at the will of waves and currents. Taken together they make up what we call the plankton. The method which had now been devised was one of measuring the organisms of the plankton, not those of shore or bottom. It might seem at first sight that nothing could be easier than to dip up a bucket of the water to be investigated, filter it and weigh and measure the animals. But it must be remembered that water at different depths might contain different amounts of plankton, and hence it was necessary that the sample of water taken should extend from the bottom to the surface, so as to include water from all depths. The sample must bear the same relation to the whole volume of water, that a disc punched from the center of a sheet of metal bears to the whole sheet. No simple method of actually removing such a sample of water from a lake seems to be possible, but an exceedingly simple method has been devised of removing the plankton from a sample column of the water. This consists merely in drawing a fine net vertically from the bottom to the surface. The contents of the net are then removed and measured and weighed, and the individual animals and plants which it contains are counted. It is necessary that the material used for the net should be so fine that it will retain the minutest organisms, and such a material is found in the finest bolting cloth used by millers. The net must further be provided with a cup at the bottom to receive the minute organisms which are washed into it. Other precautions are necessary both in taking the plankton and in its subsequent study, but these need not be entered upon here. It is enough to know that a properly constructed net drawn from the bottom to top yields a sample of the plankton in a lake, and that such sample may be weighed and measured and its constituents counted.

This method was first introduced by Professor Hansen, who used it in the study of the marine plankton and described it as early as 1887. It was subsequently modified and used in some of the fresh water lakes of North Germany by Hansen's pupil Apstein in 1890 and later. Since then the method or some modification of it, has been widely used. When we remember that aquatic plants are dependent for their nourishment on the materials dissolved in the water, and that aquatic animals are directly or indirectly dependent on plants for nourishment, we realize that a measurement of the plankton is a measurement of the relative productive capacity of a body of water. We thus have for the first time a method of determining how much organic matter a given body of water is capable of yielding, and the importance of this method for fish culture has hardly yet been realized.

Investigation by this method soon showed that the plankton of a lake was uniformly distributed. The lake might be compared to a field of wheat in which the plants were growing uniformly over the whole field. A square yard anywhere in such a field would yield approximately the same measure of wheat grains. Similarly it was found that the plankton net gave approximately the same results, no matter in what part of the lake it was used. Thus it became evident that in order to test the plankton production of a lake it was necessary to make but a single haul of the plankton net.

Now let us see what the results have been of the comparison of different lakes by this method. We are apt to think of a lake area as we do of a land area and to imagine that if a lake an acre in extent produces a certain weight of fish a lake one thousand acres in extent should produce one thousand times that weight of fish. When we turn to a very large lake, such as Lake Michigan, we are apt to think of it as we think of the ocean, as being inexhaustible. In thus imagining that the productive capacity of a lake is proportioned to its size, we fail to take into account certain important facts. The whole source of food supply for the inhabitants of a lake is contained in solution in its waters. The plants live directly on the materials thus in solution in the waters of the lake, and the animals in their turn feed upon the plants, or upon one another. When we inquire as to the source of the materials in solution in the water of a lake, we find that they have all been introduced from without. They are brought in by streams, they are washed from the shore by waves, they are, to a small extent, carried in by winds and rains. Now in a very large lake the proportion of the shallow water to the whole area of the lake is much less than in a small lake. It is in this shallow water that the wave action takes place which washes out from the soil the plant food materials which came to be dissolved in the water of the lake. This same shallow water further gives anchorage to plants which furnish shelter for many fishes and for their food. Consequently the shorter the shore line of a lake and the less shallow water it contains, the smaller is likely to be its production of fish per unit of surface area. Our Great Lakes have all a comparatively straight shore line with very little shallow water off shore, and hence should on this account alone be expected to yield a smaller proportion of fish per unit of area than smaller lakes. Their drainage basin is relatively small, and consequently relatively little plant food is probably brought into the lakes by the tributary rivers. In general, it is true that the larger the lake, the less may be expected to be its productive capacity per unit of area.

When, however, we turn to an actual measurement of the productive capacity of one of our Great Lakes by the use of the plankton method, we are astonished at the result. Those smaller European lakes whose plankton has been measured are found to fall into two classes which are called plankton rich and plankton poor. As compared with the plankton rich lakes of North Germany our own Great Lakes are found to contain only about one-twentieth as much plankton per volume of water as these. As compared with the plankton poor lakes the Great Lakes contain somewhat more than one-half as much plankton per volume of water. The Great Lakes are on the average, then, the poorest in plankton of any lakes that have been hitherto studied. I see no escape from the conclusion that they contain also a smaller proportion of fish per unit of area or volume than would smaller lakes. The great size of the lakes does not then justify us in expecting larger returns from them, it rather warns us that we should expect less. The commercial fishes of the Great Lakes are taken in large numbers within restricted areas. It is natural to assume that we are thus sampling what occurs on a large part of the lake. We fancy that we may go on fishing indefinitely, and somehow out of the huge expanse of water fish will come to our nets as fish always have come.

The capacity of a field for the production of any crop is limited. If we supply the field with a certain amount of fertilizer annually, we may take from it a certain product. If we attempt to take more the field becomes exhausted and refuses to yield. We cannot increase the yield by doubling the number of seeds planted; we cannot increase it by adding to the annual supply of fertilizer. Our Great Lakes are limited in precisely this way. Fertilizers they get from the tributary streams and from the erosion of their shores. They are capable of yielding a certain annual return in fishes. What that return should be we do not know. We cannot add to the supply of fertilizing material, as we might in small ponds. It is useless to plant more fish than can live. Enough should be planted, and until the fisheries are restored and the catching of immature fish stopped, it is not likely that planting can be overdone. But with it all let us remember the limited productive capacity of these lakes and let us learn from this that the only thorough going remedy is to restrict the fishing within that capacity. This seems to me to be the most important lesson to be drawn from recent studies in fresh water biology.

DISCUSSION.

Mr. Clark: Mr. President: In reference to this paper of Professor Reighard's, I was unfortunately called out, so that I only heard the first part of his paper, but a thought occurred to me in connection with what I did hear and I think I had better mention it. It was in regard to the different States commencing these scientific observations of the fresh water lakes. Of course, the members and others know what the United States Commission has done in a scientific way for salt water, and this thought occurred to me, it was to be regretted that something has not been done in this direction on the great lakes by the United States Fish Commission. I am glad the United States Fish Commissioner expects to take up that work, and intends to establish scientific stations on the great lakes. In a conference I had with Dr. Smith and others of the Fish Commission in Washington recently, I was told it was expected to take it up this season. They realize its importance and that it should be done, but I very much doubt their taking hold of it this session, as the money, within the last few weeks, as the superintendents here know, is short. But it is the full intention of the United States Fish Commission to take hold of that work.

Mr. Stranahan: I would like to ask the professor what the amount of plankton in Lake Erie was, as compared with the other lakes, just in an off-hand way?

Professor Reighard: We made only three hauls in Lake Erie, those were made just after a storm. We were storm-bound there a great deal, and we only had two days to work in. We found a good deal more than we did in Lake St. Clair or in Lake Michigan. Just what the relative amounts were is given, I think, in the report. I think in those three hauls we got about three times as much in Lake Erie as in the other lakes. Of course, this was in the west end of Lake Erie, where the water was shallow, and where you would expect more.

Mr. Stranahan: Would that come under the head of plankton poor?

Professor Reighard: Yes, it would still come under the head of plankton poor.

Mr. Bryant: I cannot add anything of scientific value to this paper, from the fact that I am unable to do so, as my state of knowledge is hardly up to the point, to enable me to enter into a discussion of this question from a scientific point of view, but I am deeply impressed, perhaps with the zeal of a new member, with the importance and value of enlisting in the work of this society these scientific investigators, and, for that reason I think our time of meeting, when we come to consider it, should be so adjusted that we can find at liberty and have with us those gentlemen of the various educational institutions of the country who are engaged in this work. The little experience I have had as a member of the commission—making it more of a by-study than anything else, owing to exacting labors in another field of work—have convinced me and I have felt impressed, the more so the more my experience has extended, of the necessity of having more exact scientific knowledge to guide us in the distribution of the fish we propagate. The discussion here to-day has greatly interested me. It has opened up to me the possibility that may be reached when these gentlemen, engaged from the standpoint of pure science, not from the point of immediate practical results, have pushed along the line of knowledge until they are able to tell us their views based on an investigation, and their deductions shall coincide with our experience in determining the best methods of adding to the fish product of the country. I have felt impressed, in our experience, which has been somewhat varied; we have tried various kinds of fish propagation and distribution, transplanting of small fish and of grown fish, I have thought that there must of necessity be a great deal of waste, from the fact that we were not always sure we were putting the right thing in the right place, or perhaps at the right time; and I am strongly impressed with the idea that this society can, by being a stimulant, as it were, enlist in aid of the great brotherhood of fish culturists everywhere, the scientific and the practical, and the political, if we must, in one grand army of men who are resolved to make their day and generation an epoch of results in this class of work. (Applause.)

Prof. Birge: I would like to say one word in indorsement of Professor Reighard's paper, and as to the necessity of scientific study and the length of time to reach results. Let us consider what is being done in the investigation of agriculture. I do not know what you are doing in Michigan, I presume it is the same thing as in Wisconsin, where there are between $75,000 and $80,000 spent annually by the State and National governments in the scientific investigation of agricultural problems. That is on top of the millions of dollars which have been spent in general chemical investigation which bears on the problems and the other millions of dollars which are spent by foreign governments and our own government in the investigation of special agricultural problems. Now, in spite of this great expenditure of money and of the efforts of quite an army of scientific men, they are just making a beginning in their knowledge. Now, while, as Professor Reighard has just said, the biology of the fresh water lake is a more simple problem than the biology of the field, it is by no means a simple problem. It is one which must be worked at from a scientific standpoint for a great many years before practical results will follow with the same kind of certainty that the agricultural chemist reaches his practical results to-day. We have not that degree of knowledge of the conditions of fish life that the agricultural chemists of the field when the agricultural stations were established. We have not one per cent. of the amount of information which was at their command at that time, and the work which scientific men do, and which they must do for a great many years to come, will very largely be in the direction of pioneer work, obtaining such information as the chemists obtained before the agricultural chemists went to work. It seems to me the attitude which this society takes it a reasonable one; that the scientific work must be done without anticipation of immediate practical results, in order to lay the foundation for securing practical results in the future such as agriculturalists are getting now from their experimental stations.

Illinois has begun this work in the only reasonable way under the direction of Professor Forbes. They are spending five thousand dollars a year or more in work that the average legislature would say was purely dead work. It is this measuring and counting of plankton, the chemical work, on water which must be done at the present time. These investigations do not directly aid the work of the practical fish-culturist, but they will form for the future the basis on which the practical fish-culturist will ground his work; just as the scientific farmer to-day bases his work on the results of the experimental station, which again, in its turn, rests back on the knowledge which science has been accumulating through the past generation.

The problems for us in the life of these inland waters must be taken up in that same way and worked out in that same temper, without anticipation of immediate practical results this year or next year, or even in five years.

Chairman Whitaker: It is with a great deal of pleasure I learn from Mr. Clark that the United States Commission has finally determined to take up this most important work which has been so long neglected upon the chain of great lakes. I took occasion, during the life of Col. McDonald, to urge upon him personally, more than once, the necessity of undertaking this work and carrying it on under the supervision of the United States Fish Commission. They have an organized force of scientific men who can plan and carry on this work in the way it should be conducted, and you cannot marshal too many forces of that kind. It need not interfere with Illinois. Illinois may aid them and so they may aid Illinois. A great work of this kind, it seems to me, should be done here upon the great lakes. The act under which the United States Commission was organized provided that they should conduct such investigations as to the food fish in all the waters, not only of the ocean but of the great lakes. It was a simple statement but it means a vast amount of work. It must extend, as the professor has said, over years of inquiry, and how important it will be to fish culture. We are just awakening to it. Perhaps we have thought this over personally, but the society has taken up this question for the last three of four years in a way that it never has before. How important it is to know what the conditions are in the lakes influencing the successful planting of fish. Are there barren food areas? Are there areas abounding richly in fish food? When you speak of the land, and its cultivation; when you speak of the aid that agriculture has received from scientific investigation, you recognize that that great work has aided the tiller of the soil. Whenever you broaden human knowledge by investigation, you have added very much to results. When you speak of a given area of land, and compare it with an area of water in its food producing power, and when you compare the cost of the production of the one with the cost of the other, the argument is in favor of the water. The soil is tilled, it is prepared for the seed, it is watched constantly, the crop is garnered, it is marketed, all at the cost of effort and means. But so far as the great waters are concerned from which fish food is drawn, the seed is sown and it grows to maturity under natural conditions and at practically no cost. What is the lift habit of the infant whitefish or the infant trout or any of the other numerous commercial varieties of fish during its first stage of life? Does the character of their food change when they become older? If so, what is their food after that change occurs? In what respect does it differ from the earlier stage? Do they forsake the spawning beds where they are naturally brought to life? If so, when, where do they go, what do they feed upon there? What are their natural enemies? All these things once solved add to the efficiency of the work of the fish culturiest, and this solution can only be wrought out by scientific men. Many investigations they make may seem remotely connected with fish culture, but it is not so. Look at the suggestion contained in Professor Reighard's paper, of that ever working cycle of existence and life. The lowest form that is washed into the lake basin in the nature of silt, is the food of the lowest forms of plant and animal life, they in turn are preyed upon by the next higher forms, those in turn serve as food for fish ,and man feeds upon fish, he dies, returns to dust and becomes the food of these lower forms, if you please, and so the cycle goes on and on.

I wish again to congratulate the fish culturists of the country upon the determination of the United States Commission to enter intothis field of scientific investigation. So far as the States are concerned, I feel that any aid they can render will be cheerfully accorded. We welcome the U. S. Commission to the field, and it is one of those things which seem to me to go far towards commending a public officer that he proposes to take a step of this kind, even though it should have been taken long ago.

Mr. Tomlin: It gives me a great deal of pleasure to say that though Minnesota has done very little towards establishing any such station of information, as mentioned by Professor Reighard and Professor Birge, I recognize its importance, and it does me great pleasure to confirm the statement of Mr. Clark, that the United States Fish Commission has sent out Professor Wymans, of our Duluth high school, the past two seasons to pursue just such researches as these.

The committee on place of next meeting then reported as follows:

Mr. Davis: The committee appointed by you to select and recommend a location for the next meeting unanimously recommend the City of Omaha.

On motion the report was adopted unanimously.

The Chairman: It is now in order to fix the time when the meeting shall be held. There is some force in what has been said about fixing a time, as nearly as we can, that will be a little further away from the college commencements, so that we can have the scientific workers with us.

Mr. Dickerson: I would suggest some time in the month of May.

Chairman Whitaker: Of course we should consult Mr. May somewhat in reference to this matter. There is another thing we want to look out for, and that is to put it far enough away from the season of fish distribution so we may be able to get the superintendents to attend.

Mr. May: The main reason for my asking the society to hold its meeting in Omaha next year is on account of our Trans-Mississippi International Exposition, which opens June 1st. We want the members of the society to be there after the exposition opens, on account of the exhibit we expect to make there, in the way of live fish, fish products, implements of fishing, etc. We want to make it on as broad a scale as we can possibly make it. While we don't expect to equal the exhibition at Chicago, we want to make it of as great magnitude as we can, as broad as possible. Since you have named Omaha for holding the meeting of '98 I beg of you to fix a date after the first of June, when the exposition will be in full operation. Our exposition runs until November, so any time during that period will be satisfactory to us.

Mr. Dale: I move that it be made the last week in June.

Mr. Peabody: I move to amend by making it the second week in July. I think business men, as a rule, after the 4th of July feel more at liberty to take the time. During June there is a sort of a closing up of affairs and getting ready for vacations, going into the country or whatever it may be, and it strikes me the second week in July would suit more people than any other time.

Mr. Clark: When I was on my feet before, I had in mind to offer a motion that we meet the third Tuesday in July. Your motion or suggestion of the last week in June must necessarily shut out a great majority of the superintendents of the United States Fish Commission. We are here on borrowed time really now. The United States Fish Commission superintendents at the close of the fiscal year are very busy in making up their reports. Our rules and regulations require us to have our reports in the Washington office on the 10th day of July, and business nowadays is very prompt in the United States Fish Commission, and it must be. If you want those men here you must have it a little earlier or a little later, and the state superintendents, I presume, are busy in the same way, perhaps not so much so, but to a certain extent, and I had in mind to move to make it the third Tuesday in July.

A Member: I will second Mr. Peabody's motion for the second week in July.

Mr. Peabody: I am willing to leave it to the Executive Committee, to put it any time after the 10th of July.

Chairman Whitaker: It would be an unsatisfactory thing to leave a matter of that kind to the Executive Committee. The society ought to settle this date itself, and it seems to me this is just the time to get the consensus of opinion as to what time we want to fix.

Mr. Clark: There is no very good reason, it seems to me, for having it so early. We are all aware that all the expositions we have ever had in this country, during the first two months did not amount to much.

Mr. Peabody: With the consent of the second, I will withdraw my motion.

Chairman Whitaker: The question now is on Mr. Clark's motion. The motion before the society is that we meet in Omaha on the third Tuesday in July, 1898.

Mr. Peabody: I think there is a point about Tuesday being pretty close to Sunday. It is a long distance out there, and it seems to me Wednesday would be a better day. I move you, as a substitute, that the meeting be on the third Wednesday instead of the third Tuesday of July.

The Chairman: As Mr. Clark has no objection to it, Mr. Peabody's amendment will stand as the original motion.

The motion was unanimously adopted.

Chairman Whitaker: We will now listen to the report of the committee on the suggestions contained in the report of Secretary Cheney.

The committee reported as follows through its chairman, Mr. Bryant:

The committee appointed to consider the report of the secretary, hereby report that having considered the same, they respectfully recommend the adoption of the following:

Resolved, (1) That the Secretary be instructed to furnish copies of the transactions of the society to any public libraries or historical societies or scientific institutions applying for the same.

(2) That the Secretary be authorized to procure a seal for the society, adopting the device of the association.

(3) To secure promptitude and accuracy in the issuance and publication of the reports of the society, it is urged that the proofs of all papers read be submitted for correction to the authors, and that they promptly read and return to the Secretary.

Mr. Preston: In order to make the report of the meeting read right, would it not be better first to receive the report, and then we can adopt such parts as we like. I move the report be received.

The motion was seconded and carried unanimously.

Mr. Titcomb: I move, Mr. Chairman, that the first section of that report be referred back to the committee, for correction and change after having heard the opinion of the members relative to the distribution of the report.

The Chair: The motion before the house now is the question of recommitment. It is moved and supported that the report be recommitment to the committee to consider and report again.

The motion was carried unanimously.

Mr. Dickerson: I have a resolution to offer here, handed me by Mr. Gunckel.

Resolution read, as follows:

By Mr. Gunckel:

With a view of getting a uniform law for the protection of fish in the lake states, I move that the chair appoint one representative, who shall be a member of this society, from each of the states bordering on the great lakes, as a committee for the purpose of laying the matter of fish protection before the officials of their respective states, to get ideas, suggestions and such facts as will lead to the framing of uniform laws to regulate the fisheries in all the lake states. The chairman of such committee to file his report with the president of the society on or before November 1st, 1897, when the president shall refer the report to the Executive Committee, who shall take immediate action.

Professor Birge: I move that the resolution be adopted.

The motion was supported.

Mr. Gunckel: As a matter of explanation, I will say my time yesterday was very limited here; I had to return to Toledo last night and came back this morning. During my stay at home I referred back to the records of the meetings for a number of years, and I discovered that at each meeting several hours have been expended in arguing on the object of this motion. As I have stated, by correspondence and personal conversations with some of the high officials of the United States, I have come to the conclusion that this matter, suggested last year by our present chairman, was the most feasible that could be adopted by this society. Because then it would introduce the subject and it would lead to harmony in the laws of the various States and the water belonging to the government. The government would then take some action for the lead, what we have been after for a number of years. This is a suggestion of President McKinley. He realizes the fact that the laws of the various States are in conflict, and it seems to me almost impossible for this society to work in any other way and gain that success which we have been after than this; to appoint one good representative from each State to hold consultations and discuss the matter with the officials of the various States, and it may open a field that may result favorably to this association, one of its leading objects. I emphasize that because I noticed in reading the past reports that that seemed to be one of the leading questions of the association;

the protection of the fish and the interesting of scientific men, who can spend a lifetime in study and hard work to assist us in getting more knowledge of our waters and to learn what is the best plan to protect them. I have talked and corresponded with a great many men during the past year. I took this matter up on my own account. I will not take up your time longer on the subject, but those who have been attending our meetings during the past will recall a number of arguments that have been presented from time to time, heartily favoring a movement of this kind.

The Chairman: May I ask you if you have heard of the action that has been taken in several of the lake States with reference to the matter this last winter by the legislatures?

Mr. Gunckel: Yes, I have. Since I noticed that, as I said, I have talked with the officials of the United States, some of the United States Commission, Dr. Bean and Dr. Henshall, and I heard indirectly from Mr. Stranahan, and the object is to bring this matter around through the American Fisheries Society. They are working well in the various States. They are trying to get that law. I see Delaware and Pennsylvania and some of the other States have it, but we should have our society not only meet once a year and then revive a little life when we get our reports, but we should have some work connected with it during the entire year.

The Chairman: Does your motion contemplate there shall be a representative from each of the lake states who is a member of this body?

Mr. Gunckel: Yes, a member of this society..

The Chairman: I did not understand your motion to so express it. I reported on that part of the work of last year in your absence. I did not act upon the motion of last year, because it was broader than your present resolution. It embraced the seaboard states and contemplated two committees, one for the great lakes and the other for the seaboard states. I wrote to Mr. Huntington, who is deeply interested in the matter, and asked him to send me a list of names. He sent me names, but some of them were not members of this society. It seemed to me that we would be going outside of our province to attempt to direct any one not a member.

Mr. Gunckel: I expected this would be a beginning and lead to the appointment of members from the seaboard states. I did not have time to properly form this so as to cover that.

The Chairman: I want to say for the information of you gentlemen who do not happen to know about the matter, that Mr. Bell, of Wisconsin, was the father of the movement I have referred to, and he is entitled to great credit for it. It seems there were introduced into the legislatures of Minnesota, Wisconsin, Illinois and Michigan this last year joint resolutions or concurrent resolutions providing for the appointment of representatives of those states to meet and decide upon uniform laws to regulate the fisheries. As I understand it, that is the scope of it, and each of these four states have acted on the matter. They will meet this coming summer.

The motion was seconded and carried unanimously.

Mr. Titcomb: To get it before the members before any more absent themselves, I move that when we adjourn we adjourn until two o'clock this afternoon, city time.

The motion was carried unanimously.

Mr. Bryant: The committee to whom was recommitted the secretary's report, wish to report that they have stricken out the words "for general distribution." I move the adoption of the report.

The motion was duly seconded and the report was adopted.

Mr. Davis: It strikes me it is a mistake to restrict to that extent the publication of the reports.

Mr. Peabody: I move as an amendment, that each member have an opportunity to make application for five copies of the report, and that they be sent to him if he makes application, otherwise but one.

The motion was carried.

Adjourned to 2 p. m.

PROCEEDINGS OF FRIDAY AFTERNOON, JUNE 18, 1897.

The session was called to order by the President.

The Chair: We will now listen to a paper by Mr. Seymour Bower, on Fish Protection and Fish Production.

Mr. Bower: Mr. President and Gentlemen of the Association. I have jotted down a few thoughts that I have put under the head of Fish Protection and Fish Production, although I suppose any other title would do as well. We are all, of course, deeply interested in the question of producing the greatest possible number of the more valuable species, and we are all honestly and conscientiously endeavoring, I take it, to do all we can to bring about that result. No doubt there are some who will dissent from some of the opinions that I hold on some of these questions. I will only say that my conclusions are not hastily formed. They are the result of sixteen or seventeen years of practical experience.

FISH PROTECTION AND FISH PRODUCTION.

By SEYMOUR BOWER.

While we must in the future, as in the past, depend upon scientific research to indicate the best methods of propagating and cultivating water life, yet many of the complex and intricate problems that spring from a consideration of fishery economics are of minor importance when compared with the practical and less difficult questions that arise. These minor considerations differentiate in endless ramifications, affording a broad and interesting field for the scientist and investigator. Water life, from its lowest forms up, is a mysterious maze of combinations and possibilities, involved in which are many paths that will never be explored and many secrets that will never be disclosed.

But though many of these intricate problems shall never be solved and the door to a perfect knowledge of the interrelations of water life shall remain forever barred, yet we are no worse off than the ignorant but thrifty husbandman, who, with the simple knowledge of when and how to sow and when and how to reap, secures almost as large a crop as though he understood to a nicety the combination and relation of every element and process of development.

The term "fish protection" is a deceptive generality that may mean much or little, but which is quite apt to lead the unthinking into the error of supposing that in order to carry the annual production of mature fish to the highest point, the privilege of catching them must be surrounded at every turn with nearly prohibitive restrictions, whereas, protection in its truest sense and in its true relation to production, seeks to provide an increase, not decrease, in the annual harvest of adults. The real problem, therefore, is to determine what measures shall be adopted to enable us to remove the largest possible number of mature fish from the waters each year without depleting them.

Fish life is surrounded, perhaps to a greater extent than any other form of animal, with natural enemies and dangers that imperil existence at every stage and every turn. Nature, of course, has provided for each some means of defense or escape; but there is incessant warfare and destruction from the moment the ova are laid—indeed, with many species by far the greater part of the destruction is wrought during the ovum stage. Each species is an enemy of all others, oftimes of its own. The spawning grounds of every kind of fish are likewise the feeding grounds of others, the spawn itself constituting the food; and every kind of the larger species is either a fish destroyer or spawn destroyer, or both, at some stage of life.

Of course, this preying of one form of animal life upon another begins much lower down the scale; in fact, the abundance or scarcity of the highest forms, or ultimate product, is determined by the volume of the lowest or fundamental forms. But the building up process finally results in populating the waters with a variety of animals suitable in size, form and texture as food for man. These animals embrace many species, some of which are prized far more highly than others, but all are alike without value to mankind until caught, and the importance of any water as a source of food supply depends, not on the number of animals inhabiting it, but on the annual output of adults of the more highly prized species.

Opinions will vary as to the number or proportion of adults that may safely be removed each year, but no one will deny the proposition that all of the adults of any species might be caught out each year as fast as they come to full maturity, provided that a sufficient number of young of the same species were reintroduced each year to make the loss good. Through the medium of artificial propagation, which protects the ova that nature leaves unprotected, this compensation of young is entirely feasible with the shad, the salmon, trout, whitefish, pike-perch and some other species, provided always that the catching and killing of the young and immature fish is absolutely prevented.

Where artificial propagation is thus able to supplant natural propagation, thereby eliminating the latter from consideration, it is much better to catch off the adults as fast as they mature, and thus make way for succeeding crops or generations. When fish have matured, it is time, so to speak, to realize on the investment. They should then be converted into food, either for some other fish, or for man. If allowed to remain, they defeat the very object for which they were created, namely, to be caught and utilized. The food which they consume by remaining should all be converted into increment by going to the young and growing fish, instead of being wasted on the adults merely to prolong their lives. When a female fish has matured and yielded a crop of ova to the saving process of artificial propagation, she has accomplished more in the way of reproduction that she could in hundreds of seasons under natural environment, and can therefore well be spared.

It is evident that restrictive measures need not apply to the adult fish, provided a sufficient number are available for artificial propagation, but as affecting the young and immature fish such measures should be of the most stringent character. The killing of young fish of the more valuable species is little short of criminal, and should be penalized in every possible way.

A little reflection must convince anyone that natural propagation is entirely inadequate to keep the waters stocked to their limit if considerable inroads are made in the parent stock at any season of the year, and it is a vain hope to expect nature to recover and hold lost ground by nature's methods alone, unless the waters are closed absolutely and permanently.

It is true that the catching off of one kind of fish sometimes results in increased production of others, and without the aid of artificial propagation, but such increase cannot be relied upon as being permanent, and depletion is sure to follow if fishing is continued and no restitution is made through the agency of artificial propagation.

The history of fishing waters is replete with illustrations and examples to prove the proposition that the natural hatching percentage of many species is too insignificant to offset any considerable drain on the parent stock. How often we hear the remark, "There used to be mighty good fishing over in Smith Creek, or Jones Lake, but they are pretty well fished out now." Even our best trout streams, after having been stocked to their limit, sooner or later become depleted unless kept up by occasional contributions from the hatcheries, and this, too, notwithstanding that the fishing is limited to hook and line and the season is closed two-thirds of each year. The reason for this is that it is impossible to recoup from the fish taken in the *open* season, and equally impossible to protect from natural enemies the ova deposited in the *closed* season. The unripe spawn in the adult fish caught in the open season is hopelessly and irretrievably lost, while the ripe spawn deposited in the closed season is very largely so.

Natural propagation will never force a water to its highest productive limit, unless fishing is absolutely prohibited for an indefinite period. Fortunately, this course is not necessary, for while we cannot prevent more or less destruction of one kind or size of fish by another after they leave our hatcheries, we *can* and *do* save the enormous waste that occurs under natural conditions during the *ova* stage, and thus bring into existence immensely increased numbers of young fish. To appreciate fully the significance and importance of artificial propagation as a factor in fishery problems, we must ever keep in mind this wonderful margin of gain over natural propagation.

Fish culturists and all who have carefully investigated the subject are unanimously agreed that the treatment and protection we extend to the ova multiplies hatching results five hundred to one thousand times, and some place the ratio much higher. Nor is this enormous disparity to be wondered at when we inquire into the conditions, and understand the dangers and perils to which the spawn as deposited in nature is constantly exposed.

But taking the most conservative estimate, five hundred, as a basis, and it will be seen that we produce as many fish from one pair of adults as nature does from five hundred, or that one million ova artificially treated is equal to half a billion on natural spawning beds. Or, to put it another way, five hundred pairs of breeders must be allowed to reach their spawning beds and spawn undisturbed to accomplish what we are able to, simply by lifting a single pair from the same beds and submitting the ripe ova to the treatment and protection called artificial. While the ova on spawning beds has its uses in the economy of the waters, serving, as it does, as a source of food for other fish, yet so far as reproductive results are concerned, 499 out of every 500 pairs may as well never spawn at all, provided always that the solitary remaining pair falls into the hands of a hatchery expert at the proper time. It will readily be seen, therefore, that compensation for the removal of adults is possible only when they are taken from spawning grounds, and absolutely impossible only when taken elsewhere.

It should not be inferred that an indiscriminate throwing down of the barriers to the capture of adult fish is advocated. Many species of fish guard their spawning beds and protect their ova and young from the ravages of natural enemies, performing functions that correspond with the parental care and solicitude of land animals, thus producing a large natural increase. These should be surrounded with all manner of safeguards and afforded the most ample protection during their breeding season.

But there are many species of fish whose ova yields readily to the methods of artificial propagation, that desert their spawning grounds the moment the spawn is cast, leaving the defenceless germs wholly unprotected, to be mercilessly destroyed by by a hungry horde of spawn eaters. Now, when fish of this class assemble in sufficient numbers at the proper time to permit the collection of enough spawn to recompense the annual capture of adults, or, in short, whenever and wherever it is possible and practical to make complete restitution, it is obvious that no restrictions are needed. Desirable species that shirk parental duties after throwing their ova should not be allowed to throw it; they should be headed off and forced to "cough up" in time to give the germs the treatment and protection that they deserve, instead of being allowed to go very largely to waste.

If all the salmon and all the shad that ascend our great rivers from the sea were allowed to reach their spawning grounds before being caught, the immense numbers of young that, by the grace of artificial propagation, it would then be practical to return, would soon restore the depleted waters to their virgin fruitfulness. Fishing would be concentrated to fewer points, but the aggregate annual production might thus be greatly increased, and maintained indefinitely. If these propositions are not true, then artificial propagation is a snare and a delusion and should be discontinued.

It must not be inferred that any relaxation of the protection now afforded our trout streams is to be thought of. Circumstances alter cases. We are obliged, in Michigan waters at least, to close the spawning season for brook trout and leave reproduction to nature's wasteful methods, simply because the parent fish are distributed throughout innumerable spring tributaries, making it impossible to collect the ova in paying numbers at any one point. It is a matter of the keenest regret, however, that all of the wild trout of spawning age in Michigan waters cannot be assembled each spawning season, and their ova submitted to the multiplying process of artificial propagation. There would then be no unfilled applications, no unstocked streams, for the immense production of fry each season would keep every stream stocked to its limit for all time to come.

But this, of course, is impossible, so the only alternative is to confine a stock of parent fish in ponds, simulating natural surroundings by providing an inflow of spring water over a gravel bottomed raceway into which the gravid fish are enticed. But we do not allow the fish to spawn naturally, knowing as we do by actual trial, how meagre the results would be. Nor should any fish of this class be allowed to spawn naturally, whenever it is feasible to take advantage of the saving economy of artificial methods.

The most effective methods of fish protection, then, must include protection of the ova. Protect the spawn as well as the immature fish, and there will be an abundant harvest of adults; and the universal recognition and application of this principle will greatly enhance the value of some of our most important fisheries. Protecting the adults from the hand of man, instead of catching them and protecting their ova from the ravages of natural enemies, is a striking example of "saving at the spigot and wasting at the bung."

Mr. Nevin: I fully agree with Mr. Bower in his statements, and I do not think he has made it strong enough. I do not think one egg in a million that is laid naturally in Michigan in the lakes, of the lake trout or whitefish or wall-eyed pike, will hatch. Not one in a million, naturally.

Mr. Stranahan: I indorse every word Mr. Bower has said in his paper.

The Chair: We will now listen to the report of the Memorial Committee.

Dr. Parker made the following report for the committee:

When in the regular sequence of Nature's laws, our friends pass out into the dreaded silence, having fulfilled the allotted period of life, such a going out always comes to us like a seeming disaster, for it is hard for the affections to recognize the great fact of existence that it is just as much in accordance with Nature's laws to die as it is to be born But when we can so far philosophize we can better accept the startling fact when it is brought home to us, and so in the death of these brothers of ours, whose memories we delight to cherish, let us remember that they have passed out from among us, not through any dispensation of Providence, but in strict accordance with Nature's inexorable laws. But the great ethical fact of life is, not how long in years we may live, but how well we may live in deeds and words that bring joy and comfort and happiness into the lives of those around us.

To those of this society who have known our deceased brother, Marshall McDonald, no words are necessary to tell how well he fulfilled the ethical law. Kind and considerate of the feelings of others, always a courteous and dignified gentleman, he not only commanded respect for himself, but inspired self-respect in others. While his scientific attainments in the direction of his chosen life's work, he commanded the respect of his co-temporaries. It, also, has been of value to the world.

No higher tribute could be paid to the memory of Dan Fitzhugh than the words of your President, "He was one of Nature's noblemen, a true sportsman, a brave spirit, with a heart as gentle as a woman's." And to this let us add these words from the Persian poet:

> "And when * * Oh, Saki, you shall pass,
> Among the guests, star scattered on the grass.
> And in your blissful errand reach the spot,
> Where he made one, turn down an empty glass."

D. H. F. FITZHUGH.

Of Brother H. C. Ford, his connection with this society is a matter of record, having served as its President, and for several years as its Treasurer. Born to an ample inheritance, he was so placed in life that he was enabled to satisfy his love for the "gentle art" that became to him almost the fullness of life; fish and fishing, and those who fished, were the chief sources of his enjoyment, and those who have listened to his quaint and quiet wit and humor, and enjoyed his "fish stories," will always treasure them as bright spots in memory. Quiet and unostentatious, he possessed the true spirit of one close to Nature's heart, and one always in touch with her beauty and her truth, and one so loving nature loves his fellow man.

JAMES A. DALE,
J. C. PARKER,
H. W DAVIS.

The report of the committee was accepted, adopted and ordered printed in the proceedings.

Mr. Dale then read a memorial of Mr. Ford, presented by Mr. William B. Meehan, of Philadelphia, which follows.

HENRY C. FORD.

By WILLIAM E. MEEHAN, Philadelphia, Pa.

Probably no man was better known among fish culturists, in this country, than Henry C. Ford, and no man was more greatly esteemed for his knowledge of the subject of fish culture and for his qualities as a man. His modesty and unassuming ways made him a general favorite among those with whom he came in contact, and gained for him the respect of those who knew him by reputation only. By his death Pennsylvania's fish cultural work suffered a severe loss, and people all over the United States were deprived of a friend. For some years Mr. Ford had been a sufferer from the disease which finally resulted in his death, but he bore his affliction so bravely and so patiently, that only those who were nearest to him, were aware of his trouble until a few months before the end. To a large number of his friends the announcement of his demise was a sudden and unexpected shock.

Mr. Henry C. Ford was descended from old New York and Connecticut stock, although he himself was by birth and residence a Philadelphian. He was born July 25th, 1836, his father, Isaac Ford, being at that time one of the largest wholesale dry goods merchants in the city. He was the first born, and on the death of his father became the manager of the estate, which was very large. Beyond this Mr. Henry C. Ford was never engaged in business, his father having retired some years before his death. His preliminary education was received in private schools in Philadelphia, and it was completed at Brown University, from which institution he graduated in 1856. Among his classmates were several afterwards notable men, prominent among whom were ex-Secretary of State Richard Olney, and General Tourtelote.

From boyhood Mr. Ford was fond of angling, and was early the companion of some of the most noted anglers of the day. Having abundant means, he was able to indulge to the full in his favorite sport, and in pursuit of it, at various times visited and fished nearly every noted river and stream in the country. During the latter days of his life, however, he spent most of his fishing days in Florida and at Egypt Mills, Pike County, Pa. While extremely fond of trout fishing, Mr. Ford's favorite sport was the capture of the black bass. He was probably the most expert

HON. HENRY C. FORD.

angler for this species of fish in Pennsylvania. He was, moreover, as indefatigable at it as he was enthusiastic. The Delaware river flowed only a few hundred yards from the cottage where Mr. Ford spent the summer, and where he spent the last days of his illness, and every day except Sundays, or those on which he devoted to the trout stream, or the work of the Fish Commission, were spent on the river in the search of black bass. A thorough sportsman, Mr. Ford made a resolution (which I never knew him to break) to keep no fish of this species under eleven inches long.

He grew to love the upper Delaware, with its beautiful surrounding mountains, almost as much as he did his favorite sport of angling, and when he felt that his last days were approaching, he expressed a desire to be buried within the sound of the music of its waters. I shall never forget the day on which Mr. Ford first spoke of what was in his heart in this respect, nor the manner in which he did so. It was less than a month before his death when he sent to consult with me concerning some fish cultural matters which he had in mind. When the main business was over, he said to me in that quiet, even tone familiar to many of the members of the National Fisheries Society, "Meehan, I am beginning to feel as though my illness will have a fatal ending, and if it should I want you to convey my wishes with respect to my burial to my family. I tell you because I don't want to cause them unnecessary worry now, by leading them to think that I do not believe I will recover. There is a handsome mausoleum at Laurel Hill Cemetery, in Philadelphia, belonging to my family, but I don't wish my body laid there. I want it buried in the little graveyard on the hill back of Dingman's Ferry, which overlooks the stretch of the Delaware river where I have fished for twenty-five years." He had his heart's desire. When the end came, his body was taken by a few intimate friends only, and with no pomp was laid reverentially in the little churchyard on the hill from which can be seen the sparkling pools and be heard the song of the long rifts of the Delaware river. No thought could be more poetic or more characteristic of the man; nor could a more fitting resting place have been selected for his remains.

Mr. Ford's expertness as an angler, and his broad knowledge of fish cultural matters, brought him into prominence while he was little more than a young man. For some years it was felt that The Board of Pennsylvania Fish Commissioners needed a thorough overhauling and new life put into it. Without solicitation on his part, a number of friends urged him strongly for the position of Fish Commissioner, but through some misunderstanding, the appointment was not given him, and it was not until General Beaver was made Governor of Pennsylvania that Mr. Ford received his appointment. His work was admittedly so valuable that successive executives reappointed him, his last commission coming to him on his sick bed.

Mr. Ford threw himself into the work with an enthusiasm which, together with an exercise of common sense, soon raised the reputation of the Commission to an equality with the best of other States. Soon after his accession to the Commissionership he was chosen its President, a position which he held until his death. Among the questions of importance which came before him for a settlement and action, as far as Pennsylvania was concerned, was the most suitable age, other things being considered, for the Commission to send out trout fry for planting. After careful thought he became a strong advocate of a four months old period. He held that if the recipient of trout fry planted them properly, fully as good results would follow as though the fish were what are commonly called yearlings. Properly planted four months old trout, he claimed, were abundantly able to care for themselves. Naturally there were many people in the State who differed with him on this question, but as a rule he had the support of those who took the most active and intelligent interest in the work of fish planting, and his policy was endorsed and carried out by the Commission.

One of the greatest ambitions of Mr. Ford was to firmly establish the Atlantic salmon in the Delaware river and form therefrom an industry which would rival that of the shad. An effort had been made in 1870, and a few subsequent years by the late Thaddeus Norris and a few friends, but they soon abandoned their labor in this direction as a failure, although for years after a salmon or two came into the river each season to spawn. Mr. Ford felt there was no reason why this great food and game fish should not do well in the Delaware river. He held it to be an ideal stream. Its waters are pure, and it has numerous fine tributaries of cold water suitable in every way for the fish to spawn in, and there are magnificent pools and reaches the whole length of the river, above Trenton. He held that the failure on the part of Mr. Norris and others to achieve striking success, was not owing to any unsuitable qualities in the river, but through the fry not having been planted in the right places. Mr. Norris deposited the young salmon in the Bushkill creek, near Easton, only about fifty miles above tide water. Mr. Ford regarded the fact that any salmon survived under these circumstances as indisputable evidence that the Delaware is a suitable stream for the fish in every way. Instead of planting the fry in the lower part of the upper river, he had them taken as far up as the New York State line and placed in such streams as the Dyberry and Equinunk. He followed the first planting in 1890 by others each year after, except two, when no eggs were obtainable. The soundness of Mr. Ford's reasoning was shown in 1895, when nearly a hundred salmon were caught in nets. The results were so gratifying that last year the United States Fish Commission ordered an investigation to be made by the agent taking an account of the shad catch. This official found that in 1896 nearly $2,000 worth of salmon were taken by the regular fishermen alone, and that there was reason to believe that many fish had been captured by other parties not regularly engaged in professional fishing.

Mr. Ford died before the figures could be given him, but he lived long enough to feel that he had demonstrated the possibility of making a great salmon river out of the Delaware. He felt it to be his greatest triumph, except, perhaps, the part which he took in making the river the greatest shad stream in the United States, with the possible exception of the Potomac. Mr. Ford, with his characteristic modesty, rather under-rated the importance of the part which he took in this great work, but others who were associated with him in the labor, or who are familiar with the circumstances, are confident that the ultimate and complete success was largely owing to his energy and determination. When Mr. Ford became Commissioner he found the Delaware and Susquehanna rivers full of fish baskets and other destructive contrivances for catching fish. He discovered before long that the task of ridding the Susquehanna was, for some years to come at least, a hopeless task. Maryland owned some thirteen miles of the river, and by her laws permitted fish baskets and similar contrivances calculated to destroy all the valuable fish. There were also several large dams over and above which the shad could not pass. But what was more discouraging than all was his discovery that the sentiment of the people along the Susquehanna, including most of the legal officials, were in open and active sympathy with the lawless element and against the work of the Fish Commission.

In consequence of these things Mr. Ford determined to devote his efforts mainly to the Delaware, where he would have the active aid of the Fish Commissions of New York and New Jersey. By united action the Delaware was soon cleared of all serious obstructions and of every illegal device, in spite of bitter opposition on the part of the fish basket men. As a result of this work the catch of shad in the Delaware now reaches a half million dollars in value at the nets every year, while that of the Susquehanna has sunk to barely $20,000 a year.

For five years Mr. Ford was Treasurer of the American Fisheries Society, and in 1893 was its President. He was also a member of a number of angling and fish protective associations, on all of which he left the stamp of his energy and enthusiasm.

When the United States and Canada determined to make an effort to adjust the differences which existed between the two countries over the fish laws, Mr. Ford was made one of the Commissioners. The international body was in existence for about two years, and it was one of the disappointments of his life that little of value to the two countries was accomplished.

Mr. Ford never became a candidate for any public office but once, and that was shortly after the death of Col. Marshall McDonald, United States Fish Commissioner. He then stated frankly that he had an ambition for the office and made an effort to secure it. He was backed by many powerful friends, but long before President Cleveland came to any decision in the matter, a sudden and alarming turn in the condition of Mr. Ford's health compelled him to withdraw as a candidate. This was in the beginning of the winter of 1895-96, and less than a week after his withdrawal as a candidate for the United States Fish Commissionership, he was confined to his house by what proved to be the last and successful onslaught of an illness from which he had suffered more or less for many years. Between December and May, Mr. Ford was able to leave the house but two or three times. In the latter month he was taken to Egypt Mills, where he was at last beside his beloved river, which, through his fostering care, had become famous for its commercial and game fish. He died on the 17th of August, a few days after an operation at the German Hospital in Philadelphia. Six weeks before his death he visited the river and fished for the last time, and there was something pathetic and deeply touching in his behavior on that occasion and which illustrated forcibly how deep a hold fish culture and angling had upon him.

I had been through a large portion of the State, engaged in investigating some fish cultural work and other matters for the Commission, and one evening in the latter part of June went to visit Mr. Ford and to report the results of my investigations. For a week or more before my arrival he had been bedfast and low-spirited, and his family thought it best to keep from him knowledge of my arrival until the next morning, fearing the excitement of it would be injurious. Their precautions were in vain, however, for he heard me come in the house and would not be satisfied until I had been brought to him and he had heard the results of my journey. These, fortunately, were of a satisfactory character, and he went to sleep that night in a much more cheerful frame of mind than for some time previously. The next morning, to the suprise of all, Mr. Ford appeared at the breakfast table and announced his intention of going to the river to fish, and in spite of protests he did slowly take his way to the river, accompanied by his wife ,and there he was rowed about for a few hours while he fished. He was so weak then that the last of three or four medium-sized bass so thoroughly wearied him that assistance had to be given for the landing. This relation may seem to some to be trivial, but it is a striking illustration of the passion which dominated nearly the whole of his life, and which led him almost with his dying breath to request that he be buried on the little hill overlooking the river and the stretch of water that he had fished for twenty-five years.

Mr. Ford was an enthusiastic fisherman of the best type. He loved all that was good in the world, and while he hated and despised evil, he neither hated nor despised those who, through environment or other causes, committed evil. He pitied the being while he abhorred the act. It has been my lot to be brought into contact with many and diverse phases of human character, but I never intimately knew a man with a purer life or a better nature. A great city daily, in commenting editorially on the death of Mr. Ford, likened him to Isaac Walton, the greatest exemplar of the gentle art. It was a happy thought and an apt comparison. There was a remarkably close resemblance between the two as we are fond of picturing the mind and character of the great English angler. Mr. Ford lived his life as a good man should. He tried to do good for his fellow man and those who came into contact with him were the gainer thereby, and the world was the better for his having lived in it. His death caused a distinct loss to fish culture.

President: It seems to me that Mr. Ford's life and character have been so fully presented in Mr. Meehan's paper that nothing further remains to be said. Mr. Ford was a member who devoted much of his time to the success of the American Fisheries Society, and he was a member whom we had all come to respect, and his memory is one we shall all cherish.

We will now listen to a paper by Mr. J. W. Titcomb on the Collection of Wild Trout Ova; Methods of Collection and Utility.

WILD TROUT SPAWN; METHODS OF COLLECTION AND UTILITY.

By J. W. TITCOMB.

The method of securing an ample supply of wild brook trout spawn is so easy in localities where the parent fish abound, and so little has been said about this feature of trout culture, that I make bold to give my experience in this work.

Perhaps I should apologize for describing in an article before this Society a method of fishing of ancient origin which has for many years been applied by fish culturists to the capture of trout, fontinalis and anadromous fishes, but I have never seen this method written up in detail as modified for the capture of trout, and it seems a necessary part of a chapter on trout culture under the title on which I have written. I have reference to the first method I shall describe for the capture of the parent fish.

It is well known to all fish culturists that trout vary in their habits of spawning, or, rather, in their selection of spawning grounds. While brook trout in brooks almost invariably ascend to some point beyond their natural abode, or into some spring brook tributary to the main stream, it is not always the case that brook trout in lakes and ponds seek the tributary streams for their spawning grounds. It has been my experience that brook trout living in ponds quite as frequently spawn in them as in some tributary stream, even if the latter apparently affords good spawning grounds. In Vermont, the earliest run of trout begin to spawn about the middle of September, although they have begun to seek suitable spawning beds at least a month earlier. It is therefore necessary for the fish culturist to guard against the ascent of the fish long before he is ready to trap them if he is looking for stream spawners. This is accomplished by the use of a weir stretched across the stream where the trap is to be located, as early as the middle of August. As this weir can be used as the upper side of the proposed trap later in the season, it is desirable to construct it with that object in view.

Location.—The location of a trap should be made at a point where it is least likely to be inundated or washed out by freshets, which would allow the escape of many fish when they are most likely to be running in greatest numbers. A point on the stream near its mouth is advised, or at some place below any possible spawning bed, but not near enough to the outlet to be affected by back water from the pond. It is desirable to have a slight fall of water at the entrance to the trap. In order to avoid washouts, the selection of a point where the channel is broad

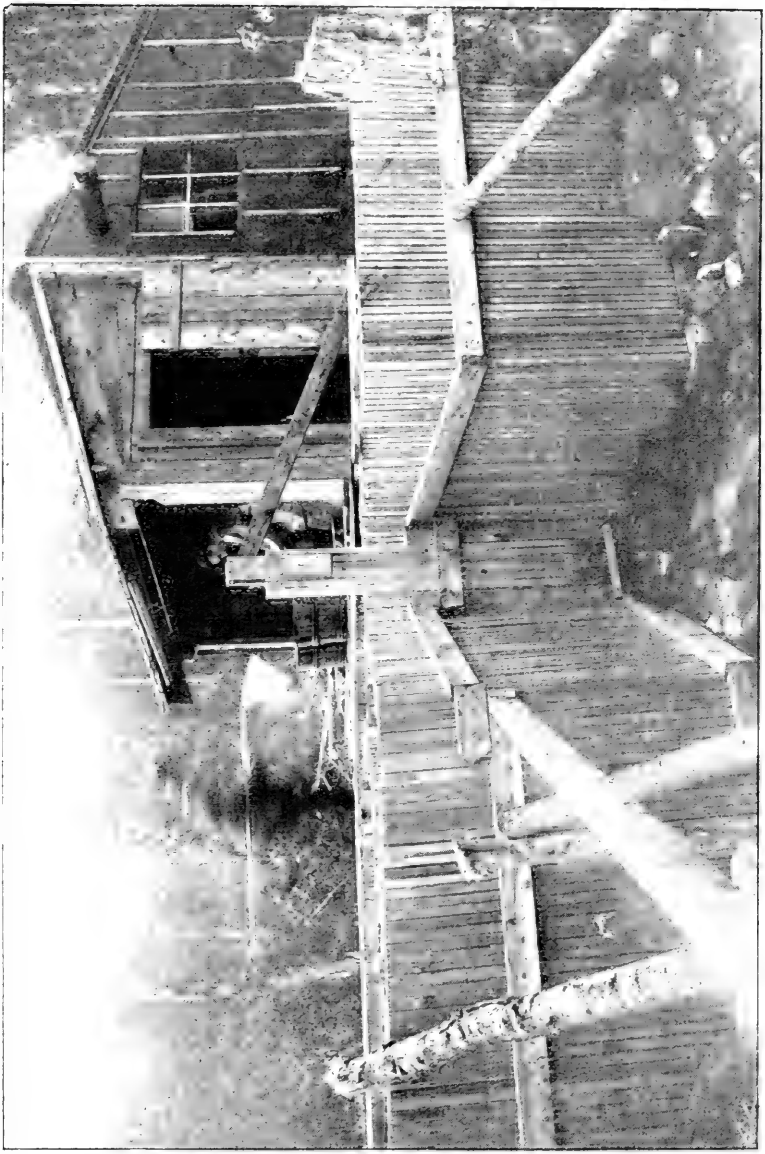
EQUIPMENT FOR TAKING WILD TROUT FROM THEIR SPAWNING BEDS AT NIGHT.

is preferable. The slats of the weir occupying about four-fifths of the natural waterway, will act as a barrier to raise the water above its natural level, more or less.

Construction—The trap is a V-shaped enclosure described by the mathematical term, "re-entering polygon," made of slats varying in dimensions with the size of the stream and the force of the current. I used slats one inch square, planed on two sides, driven into the bed of the brook vertically, about one-fourth of an inch apart, and nailed to horizontal timbers or hewn logs. This framework of horizontal timbers consists of one course laid at water level and a parallel course at the extreme height of the weir. The general idea of such a trap is the same as the pound net, there being an opening of four or five inches in the angle of the V. A gate can be arranged in the entrance with a lever reaching to some point obscured from the view of the entrapped fish, which can be lowered whenever the trap is approached for inspection. This method of trapping trout is not new, but requires more precautions than for the capture of other fish less active and gamy, and a few words of caution to the inexperienced may be desirable. Build your trap to resist the greatest freshet the stream is liable to develop. The run of trout at such times will be greatest. Be careful to get a foundation that will not be undermined by the constant washing of the current between the slats. It is usually best to entirely surround the sides of a trap with slats rather than to depend upon the natural embankments. It is not necessary to use narrow slats for the sides of the trap, as no water passes through them, and the only object is to secure an enclosure from which fish can be easily dipped out. For a stream six feet wide, I should build an enclosure about six feet square, the V extending into the enclosure about three feet.

In many localities it will be found possible to dig side ditches above the trap and enclosures, at right angles with the stream, in order to convey surplus water away from the trap and lessen the danger of washout or inundation. The bottom of such ditches should be considerably above low water mark to carry off surplus high water.

A convenient place for the pens is just above the trap, so that the trout can be dipped from the latter into the former. They are constructed of the same material of which the trap is made, the upper side of the trap enclosure being used as the lower side or end of a series of pens. These should be made in shape



View of Trap Showing Entrance for Brook Spawners.

and size to suit the location and number of fish expected to be captured, and the same precautions should be taken with them as with the trap to guard against washouts. In many instances, the bed of the brook is hard gravel and stones of large size, preventing the driving of the slats into it. In such cases it is desirable to make an apron at the base of the slat-work upon which the water will fall as it passes through them and prevent washing out of holes underneath the slats. This apron can be made of boards as an artificial bottom to the trap or pens, but a cheaper and quite as serviceable method is to place evergreen boughs or green underbrush at the base of the slat-work, covering the same with crushed stone or small stones from the bed of the brook, and then with coarse gravel. This feature of construction is very important. If there is a hole in the trap or pens large enough for trout to escape, they will surely do so. In fact, they will dig out under the slat-work if not properly guarded against. It is well to have planks extending over the trap and pens on which one can conveniently stand to dip out the fish. Adjacent to the trap and pens, a rough board shanty can be constructed or a tent can be temporarily used. There will be many stormy and cold days, however, and I advise having a shanty with facilities for heating it, and with a bunk where the attendant can sleep. Add to this equipment a reflecting lantern. Field stations of this description are usually some distance from habitation and the ordinary comforts of camp life should be available to insure good work of the spawn taker.

I have described one of the field stations operated by the U. S. Fish Commission in Vermont. The accompanying photograph gives a more distinct idea of it. The cost of such a station equipped for work will vary from $30 to $100, according to facilities for obtaining materials of construction, etc. At this station the first run of trout occurred on Sunday, August 23, when 1,650 trout ascended the brook during a rain-storm. Few trout were caught after this date until Sunday, September 6, when about 1,000 more were taken. On September 11 my records show that 3,335 trout had thus been taken. The fish continued to run in schools every rainy day, with a few stragglers every day until the end of the month. October 15 some of the slats to the trap were removed after 7,138 trout had been captured. There is no other tributary to the pond where these trout could run, except in the wet season. In the latter part of September it was discovered that a large number of trout were ascending a "dry brook," so called, in large numbers. At the request of the owners of the pond, these trout were not disturbed, although it is doubtful whether their spawn would ever amount to anything deposited in such a stream. The discovery was occasioned by the fact that the trout had stopped running in the stream in which the trap was located, the inference being that they had learned of their danger and sought new spawning grounds. Whether such is the actual case, cannot be decided until after another season's work. The pond from which these trout ascended into the trap is an ordinary mill pond of about forty acres, used to float logs into a mill, and with no screen at its outlet. The trout average about five to the pound, and the females of this size yield an average of 560 eggs. About 1,000,000 eggs were taken here, a part of which were eyed in a tent supplied with water from an adjacent spring, a part being transported to the St. Johnsbury station as soon as stripped. In connection with a collecting station distant from the hatchery, it is advisable to have a few troughs set up for eying the eggs before transportation, if suitable water can be obtained for the purpose. The natural brook water is ordinarily of low temperature and too full of sediment to warrant using it for such temporary work. If an adjacent spring is available, troughs can be set up in a tent or shanty and the eggs thus eyed in from thirty to forty days before the most severe winter weather sets in. For this work I use deep troughs and stack the trays ten deep. The first stripping of eggs occurred September 26th, when 66,000 were taken. The second and largest stripping occurred October 7th, when nearly 500,000 eggs were taken, and the trout had all been stripped and liberated on November 7th. During the season only eighteen trout died. The cost of operating this station during the season, including team hire and transportation of eggs to St. Johnsbury station, was $256.83, exclusive of services of one regular station employe two months. This cost included the cost of construction of trap and shanty, some of which would not enter into the expense of another season. For this privilege of taking trout liberal returns are made to the waters in fry.

Lake and Pond Spawners.—The method of taking trout from spawning beds in ponds differs materially from the method just described. The following is a description of a field station and methods of operation where the trout spawn in the lake:

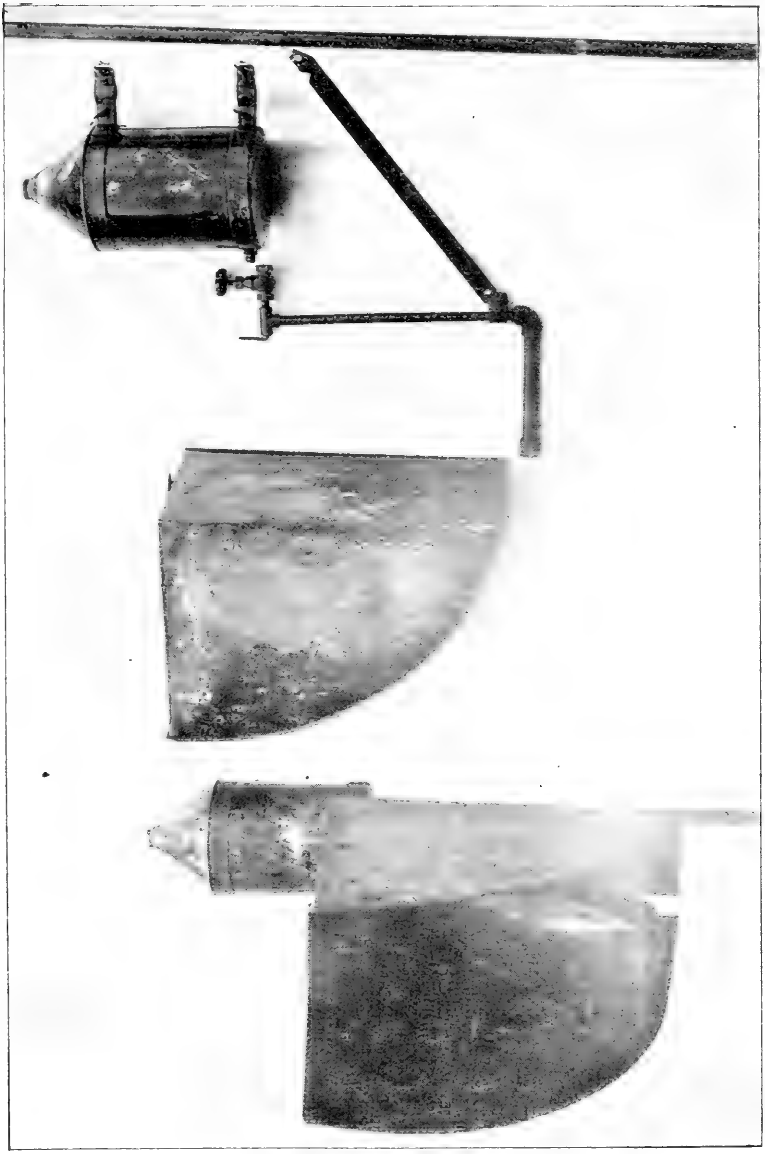
One of the first important features is to have suitable retaining pens in the lake where the trout will be undisturbed and secure from poachers. I am describing a station at a lake of 1,500 acres area, subject to high winds and rough water. The first year that collections were made at this station a breakwater was constructed of lumber and stones as a partial shelter to the retaining crates, the latter being anchored in shallow water and weighted to the bottom so that they could be approached by a walk from the shore where a small tent had been erected in which to strip fish. The crates were always a source of annoyance for fear they would be robbed or broken up by high winds. The fishing was conducted in calm weather, day and night, and the stripping in stormy weather. Lake or pond spawners usually deposit their spawn later in the season than the brook spawners, and the weather is inclement for outdoor work such as stripping trout. As a result, the percentage of eggs eyed at this station was not what it should have been. The following season a boat house was constructed with retaining pens within it and of sufficient size to give ample room for spawn-taking operations. In this house a stove was set up, and thus the work of taking spawn could proceed without discomfort during the most severe weather of November and December. Of the eggs taken at this station last season, 97 per cent. were successfully eyed. The feature about the boat house to be considered in connection with the work, aside from the comfort of the employes, is the method of building retaining space for the brood fish. Two piers were constructed about six feet wide by twenty-four feet long, and laid parallel to each other eight feet apart. The material for the piers consisted of water-soaked logs taken from the lake, with the addition of a few trees cut near by. The logs were piled crib fashion, fastened with drift bolts and filled with large stones. The two piers were tied together at each end by stringers of logs, and constituted the foundation upon which the boat house was built. The space between the two piers or the inlet to the boat house was occupied by four crates, each six feet long by four feet wide by four feet deep. The log piers are not at all water-tight, only large stones being used to sink them, and with the eight-foot opening at the sea end of the boat house, furnish ample opportunity for aeration of the water in the most calm periods. To guard against heaving by ice, which freezes two feet thick on the lake, the outside of the cob piers was covered with planks fastened vertically but sloping out in the form of a battered wall, so that the ice cannot get a hold on the piers sufficiently to move them. The planking should not extend but a few inches below low water level or it might interfere with the aeration of water in the crates. The trout were thus free from poachers, and also from the prying eyes of curious people. It may be remarked here that wild trout should not be disturbed in confinement any more than is absolutely necessary. Between 400 and 500 fish were retained at a time, one crate always being kept empty for use in transferring unripe fish.

Methods of Capture.—The implements used in the capture of lake spawners consist of spacious but easy-running boats, tooth-nets, dip-nets and jack-lights. I erroneously designate as "tooth"-nets, gill-nets of a mesh too small to gill the fish.

The above described station was equipped with one each 100-foot and 200-foot gill-nets of $1\frac{3}{4}$-inch mesh ($\frac{7}{8}$-inch knot to knot) and 6 feet deep, colored blue. Fishing was conducted day and night, or when the weather was favorable, lee shores being selected if the wind blew, it being necessary to have the water calm enough so that the fish could be seen upon their beds. The dip-nets resemble large landing nets, the hoop or net frame being 15 to 20 inches in diameter, made of $\frac{1}{8}$-inch gaspipe and the net being 2 feet deep, of as coarse a mesh as the size of fish to be dipped will permit without gilling them. It should be of rather fine thread and barked or colored blue. The latter color is best for work at night. After a fisherman has had experience with dip-nets, he will have his own ideas about the style of net, dimensions, etc.; but the general description given above will hold good with all. The technical description of a dip-net for ordering from the manufacturers is as follows: "52 meshes round, 28 inches long, $1\frac{3}{4}$-inch mesh, 16-6 cable, barked, with twine strung through the top 5 feet long."

I have tried several forms of dip-net frames and finally settled upon the $\frac{1}{8}$-inch gaspipe as the best for lightness, strength and durability combined with cheapness. A better but more expensive net frame can be made by the same method that pitchforks are made, only continuing the process by drawing the tines of the fork around until they complete the arc of a circle. This form of net frame has the advantage of being strong, light and more slender than the gaspipe for rapid work under the water. The handles of the dip-nets should be of light and strong material, and I have found nothing equal to the bamboo for them, using 8 or 10 feet from the butts of fishing poles.

The jack-lights are an important feature of this work, the larger part of which is done at night. I have tried reflecting lanterns of many kinds, but have found nothing equal to the light constructed as per accompanying photograph. It consists of a gallon can fastened to a gaspipe standard, so that it can be raised



JACK LIGHT FOR DIPPING WILD TROUT FROM THEIR SPAWNING BEDS IN LAKES AND PONDS.

or lowered, also revolved in the arc of a quarter circle. To this can is attached a supply pipe to conduct kerosene oil from the can to a perforated burner suspended over the water. This conductor has a globe valve in it to regulate the supply of oil. The conductor is $\frac{1}{4}$-inch gaspipe about 12 inches long. The burner is $\frac{1}{2}$-inch gaspipe 6 inches long, with cap at the end. The perforations in the burner are 1-32-inch in diameter, and should not exceed 20 in number. The burner is made of larger pipe than the conductor to it, as a convenience in winding asbestos wicking, which is loosely wound upon it and fastened with fine wire. Cotton batting or bagging can be used for this purpose, but is not as good. The burner when wound with asbestos resembles in shape a bobbin of cotton. A shade is necessary to protect the fishermen from the heat and glare of the light, and for convenience should be detachable. Galvanized sheet-iron is good for this purpose. For night fishing the light is suspended over the bow of the boat, the standard being screwed into a cast-iron foot, which latter is attached to the boat by means of a lag screw. The same method of fishing is employed whether by day or night, the jack-light being the only additional feature at night. The gill-net is then thrown around the spawning bed, the fishing boat is run inside, and a man with a dip-net stands in the bow ready to dip the fish. He directs the guidance of the boat, which is propelled by one oarsman. The fish are easily seen on their beds in from one to five feet of water, and remain undisturbed until the dip-net approaches them. If they lie facing the net, they can be usually picked up. Sometimes a pair can be taken together. When several are on the same bed, those that are frightened away invariably start directly for deep water. In their sudden plunge they run against the gill-net, are caught by their jaws, and in their struggles wind up in the net. The cork floats of the net are painted white to facilitate seeing them at this stage, and the fish thus caught is easily taken by holding the dip-net under it and then shaking out the gill-net. The sport is exciting, and fishermen forget the time of night, even if the thermometer registers far below freezing point. This method of fishing with dip-nets was first employed in taking the lake trout (s. namaycush), and has been in vogue in New Hampshire for several years, the use of the gill-net not being required. It required much urging and practical illustration before the spawn-takers would believe that brook trout could be dipped up in the same manner. As fast as dipped up, the fish are put into tanks of water and kept in the boat until forty or fifty trout are captured. Common sugar barrels will do for tanks. Seines can be used to advantage if the spawning grounds are smooth enough; but the majority of them are not. It has been my experience that the dipping process is less expensive than seining even on smooth grounds. The fish run best the first part of the night, and night fishing is conducted from dark until midnight. The spawning season of brook trout in lakes varies the same as it does with those spawning in streams, and is apparently affected by the height of the water. The first fish captured in the lake last season were taken October 29, 1896. The last ones were taken December 2, after which time the lake was frozen over. The trout could be seen at work on the beds long after the ice closed over the lake, and, in fact, until after January 1, 1897.

The total number of trout taken with dip-nets was 1,457; average weight of each fish a little over a pound. The number of males exceeded the number of females in the proportion of two to one. This has been the experience in the work of three seasons. The first stripping occurred November 6 and the last December 11. Total number of females stripped, 362; total take of eggs, about 500,000. The eggs were eyed in a shanty fed by springs near the lake, three troughs of trays in stacks being used for the purpose. As a matter of information, twenty-nine female trout, stripped of spawn at this field station November 26, 1896, were measured and weighed and the number of eggs yielded by each recorded. The girth, as given in the following table, was taken before the trout were stripped and with a scale which might not be regarded as entirely accurate, but approximately so. Some of these trout had apparently dropped part of their eggs before being captured.

Length in inches.	Girth in inches.	Weight lbs.	Weight oz.	No. of Eggs.
13	7	1		1,394
18	7½	2	6	2,665
10	7½		6½	492
11½	6½		8	615
17	11	2	1	2,563
17½	11	1	14½	2,358
8½	4		3	130
12½	7¼		11½	1,312
12½	7		10	820
11½	6¼		8	410
11½	6		8	615

10½	5½		6½	308
12	7		9½	820
16½	9	1	10½	923
11	6		8	615
13	6¾		11½	1,025
17	10	2	1	2,665
13	6½		11½	923
11½	6¼		11½	820
12	6		10	718
16	9½	1	9	1,845
10	5¾		6¼	656
16	10	1	14½	1,948
16¾	10½	1	12	2,563
14½	8	1	2½	1,845
13¾	7¾		14	1,074
16	8¾	1	8	1,845
17	10¼	2		2,665
15	9¾	1	8	1,948
	Total for 29 trout,	31	6¾	38,580

The average weight of fish taken throughout the season will exceed that deduced from the above table, the males averaging in weight much more than the females. There is a very marked difference in the size of eggs of brook trout taken from different waters, and the size of the eggs does not depend upon the size of the fish. The variations in size of eggs taken at three field stations last season were in the proportions of 34, 41 and 42 to the square inch respectively. The eggs numbering 34 and 42 to the square inch were taken from fish averaging five to the pound, while the eggs 41 to the square inch were taken from trout averaging over a pound each.

I will not discuss the subject now, but I believe that after successful field stations like those I operate have become permanently established, it will be advantageous to study the conditions surrounding the spawning grounds of each and see if the eggs do not require different conditions of water supply in artificial work such as volume of water to each trough, etc., to produce the best results.

Utility—In the collection of brook trout, the writer has always borne in mind that eggs can be purchased at very low prices, after they have been brought to the eyed stage; in fact, it is difficult to attempt to compete with the commercial fish culturist in the cost of wild trout eggs laid down in the hatchery as eyed eggs, because the cost of eggs thus collected should not exceed the cost of eggs of the domesticated trout, either being figured as eyed ova laid down in troughs where they are to be hatched; otherwise it would be expedient to buy eggs already eyed. There are some advantages about having the eggs of wild trout. The latter, if in suitable waters, would naturally be stronger fish than the inbred fish of the commercial hatchery. In answer to this argument, the commercial fish culturist will tell you that he frequently makes exchanges of eggs and fish and uses many precautions to keep up his stock of hardy fish. As a rule, the eggs of domesticated trout will eye and hatch a larger percentage than wild trout. Much depends, however, upon the facilities for taking the eggs of the latter, which means, also, the methods of taking the fish and retaining them until stripped. The lowest price I have been quoted by commercial fish culturists for eyed ova of brook trout is $0.70 per M. in lots of a million or more. To this price must be added expressage on the eggs to hatchery where they are to be propagated. To sum it up in one sentence, the utility of collecting wild trout spawn depends upon whether the cost of eggs thus collected is less than the cost of purchased eggs. Another point to be considered is whether the spawn deposited naturally would yield a large percentage of fry.

I have mentioned a so-called "dry brook" in which the trout congregated in large numbers at one of my stations. One month before these fish ascended it, I personally examined it. It was then apparently a surface drain fed by a slight seapage of water from the muddy soil along its banks, but practically dry. I decided that it would be impossible for trout to ascend it even during rain storms, and still believe that no spawn deposited in it would ever mature. I have visited several ponds where the trout cannot possibly ascend the feeding brooks until high water. When they do succeed in making the ascent, they have no time to prepare their beds, but must return to the lake in from twelve to twenty-four hours. The results from eggs naturally deposited in such places is practically valueless. In the case of lake spawners, the same spawning grounds where I operated were being cleaned by later spawning trout for a month after I discontinued my collections. The eggs of the fish I took, if deposited naturally, would have been eaten by the later comers or by the suckers and minnows which follow after them.

Many private clubs have well stocked ponds and a man to look after them, and yet purchase eggs for restocking. The utility of saving the spawn going to waste in such places needs no further argument. The cost of wild trout eggs will vary as a matter of course, and I have not found suitable or what I call paying stations without trying several which were afterwards abandoned. I have not written this article to encourage competition with the commercial trout culturist, but to encourage a larger production of trout with the means available in State commissions or private preserves. I am unable to say whether the collections made in this way are less expensive than carrying a stock of brood fish as in vogue at State hatcheries and institutions of a similar character, but this method can be used to advantage as an auxiliary to such institutions.

DISCUSSION.

Mr. Bryant: I would like to ask you in respect to one topic you touched upon there: What is your observation, if you have any, as to the difference between planted fish where the spawn is taken by your method from the wild fish, and the other and older form of spawning domesticated fish? Have your observations extended so far as to know the nature of these fish when they grow up? For instance, taking the fry from the fish fed artificially, they become deteriorated probably from confinement, possibly from in-breeding. When you distribute the fry you take from wild fish, do you find them in a lively condition when they grow up to maturity in the wild state? Is there any difference between those fish and those taken from domesticated fish?

Mr. Titcomb: I am not prepared to say. Fry of wild fish, as you are aware, are fed like other fry and they take food like the fry from the domesticated fish.

Mr. Bryant: In our ponds we had 55,800 trout on the first day of April, and most of them were born in the ponds. I would like to get some information as to the character of the offspring of that class of fish when they grow to maturity, having been planted in good natural water. Mr. Clark is probably able to give some information on that point.

Mr. Clark: Your question, as I understand, is: what the difference is, if any, after they are planted. I do not know as I understand your question.

Mr. Bryant: After they are planted and grown.

Mr. Clark: That is hard to tell. Unless some stream has been stocked with fry taken from wild fish and another stream stocked with fry from domesticated fish. As I understand this matter, there has not been time enough since they began to get the wild eggs to know. Mr. Titcomb has taken them three seasons.

I took eggs on the Au Sable river last fall from wild fish and the methods I pursued were somewhat different from Mr. Titcomb's. I got something less than half a million eggs, 400 and some odd thousand, and the fry from those eggs were vigorous, more so than fry from our domesticated trout, but those we reared in the pond after six months or so of feeding you could not tell from the others. Now, the planting of those back in the streams and the results afterwards, I do not know. Of course, we put one hundred thousand we got from the Au Sable right back into the Au Sable.

Mr. Bryant: I can see how in-breeding might deteriorate them. It might tend to reduce their fecundity, they are hardly as vigorous. When they get grown up in wild waters, are they as vigorous as those "to the manner born"?

Mr. Clark: As your domestic fish breed in and in, necessarily the percentage of impregnation must be lower, is that the idea?

Mr. Bryant: Yes, sir.

Mr. Clark: I do not know whether that is so or not. It is not so according to our experience.

Mr. Titcomb's 97 per cent. was a startler to me. Our experience with wild trout eggs was not anything like that. I did not suppose it was possible to get as good impregnation from wild trout as from domesticated fish.

Mr. Titcomb: Ninety-seven per cent. of impregnation was got from the trout from that one lake only, but we had a most perfect water supply. At the station where we took eggs in the trap we only got 27 per cent. of impregnation. I did not mention that in the paper, because I did not attribute it to any lack of the failure of the principle, but to a lack of something in the operations.

Mr. Clark: We tried several experiments on the Au Sable by different spawn-takers, and have tried every conceivable way, and we could not begin to get any such percentage.

Mr. Dale: What did you get?

Mr. Clark: An average of about 70 per cent. and I attributed it to the fact that they were wild fish.

Mr. Bryant: How far did you transport them?

Mr. Clark: We had a temporary hatchery right there The best water and the finest water I ever saw, and our troughs were set right up over the stream. The eggs were put on gravel. All our green brook trout eggs are put on gravel when they are first taken, and I pursued the same plan there.

Mr. Titcomb: We put our eggs five thousand to the tray and about ten trays deep.

Mr. Clark: That is my plan for brook trout when first taken, and has been for a good many years. Right on this subject, there is another thing I would like to speak of and that is the different methods of catching wild brook trout. On the Au Sable River we got the fish from the beds with a seine. In the first place, I undertook to sweep the river. I cleaned the ground for hauling a 150-foot seine, but with that we did not succeed in getting many fish; but with a small 20-foot seine, by going on the beds and having a man above and a man below to keep them from running up and down, and two men with the seine to dip up the fish, we got from 5 to 132 at a haul. We got as high as twelve or fourteen hundred fish in three or four hours. Of course, part of them were culled out. We got altogether between five and six thousand fish in that manner. But I do not think your trap that you described, if I understood it, would operate successfully on the Au Sable River at all. It is too large a body of water and has too rapid a flow. That can be done successfully with the dip-net, by operating it just at the spawning time

On the Au Sable River, I found, instead of pairs making beds, there were hundreds of trout on a large bed. They sometimes have a place cleaned up as large as this room where it will be all perfectly clean and in such a place as that I would sweep the seine, and caught as high as 132 in one haul and a good many of them got away from us.

Another point Mr. Titcomb brought out was the fact that these trout run up this trout stream, from being disturbed, to other places. That was not our experience at all. Our experience, with marked fish, was that they would go right back on to that same spawning ground and be caught again. We took fish from this bed and took them to our camp half or three-quarters of a mile below, and stripped them. Of course we turned all our fish back into the river, marked some, and we would catch the fish right on the very same bed—the marked fish. We marked the fish with a tin tag and caught them over again.

Mr. Titcomb: I did not mean to be understood that the fish had taken the cue from the fact that we had caught them from one brook and then gone into another. I left that as an open question, and I still leave it as an open question, and I am glad to hear Mr. Clark's ideas on this subject. With the lake fish, that was our method of fishing. We took once 140 fish at a haul, but I found after a while that that method was not practical, as there was only one bed in the lake where we could use that method. Our boats in the lake require a 200-foot clear sweep in order to swing around the whole bed Sometimes there would be six fish in a circular nest, but ordinarily we would strike two fish together—that is, they would run together.

I want to say another word about that trap. The streams of Vermont, where the brook trout are now found, are mostly small streams, ten to fifteen feet wide, and it is hard to build a trap in a small stream. The trout all run in that small entrance. The most of our waters are trout waters. Some of them have been spoiled by putting in pickerel and other coarse varieties of fish, and the nature of some of our streams is being changed so that we cannot hope to restore trout fishing in them. We get some good results from stocking our trout ponds. These mill ponds I described are simply ordinary trout streams, four by six feet in width, dammed up simply for the purpose of floating logs, and it was several years before they discovered they had such a wonderful trout pond, and it was one of the most prolific natural breeding places I have ever known. The trout had originally the forest stream to breed in, and had no falls or any great rapids in the brook, and it was fed by little bits of springs running into it.

Mr. Bower: I want to say that Mr. Titcomb is certainly very fortunate, more fortunate than we are in Michigan in having these places to get the wild trout from. With the exception of the Au Sable River, and perhaps two or three other streams, we are not favored as you are in Vermont. We have no lakes stocked with brook trout from which the fish run into the streams.

The method employed by Mr. Titcomb in catching the trout is substantially the same as we used at Green Lake Station, where

I was stationed for some months, and while it worked very successfully, there was great annoyance in connection with the catching of the fish that I don't think you referred to—if you did, I did not hear you—and that is the streams running down through dense woods along about the time of the year when the fish were spawning, were covered with immense quantities of leaves, and we had continuous trouble to keep the rack free, and sometimes there were periods when two men would be kept constantly busy at the screens, and it occurred to me to ask you you managed to obviate that difficulty, if you experienced it.

Mr. Titcomb: I did not carry that point far enough in my paper, Mr. President I spoke of having a shanty and bunk, where a man could sleep. He was isolated in the woods, and at the end of sixty-six days he wrote for leave of absence to go home and visit his family. He kept a rake there and raked off those leaves, and one night he took 1,600 trout in that trap, and he was dipping as fast as he could dip. He was an old fisherman, one of those old hardy fishermen that always know where the big trout are in a stream. He was out there alone, and he wrote me a long letter, stating how the stream came up, and he woke up in the night and the water was flowing all around his shanty, and he didn't know whether to stay or run, and then he found if he ran he had to wade through a stream up to his waist, and he stayed and dipped until midnight.

Mr. Bower: That was on account of the leaves?

Mr. Titcomb: No, sir, that was on account of the pressure. The water was high. The weir takes up four-fifths of the brook, and the opening is not sufficient in case of such a rise. That trap method I did not pretend to originate at all. It is simply a method of fish culture which it seemed to me had not been written up, and I wrote it up for that purpose. The method of dipping them off the beds is one which I originated; I may not have originated it, of course the Indians used to dip in olden times, but for my work it was original with me.

Mr. Bryant: Those traps were first used in Maine by Mr. Atkins.

Mr. Titcomb: Yes, I corresponded with him about it.

Mr. Dickerson: Are all your lakes stocked with brook trout? Do they grow in all your lakes?

Mr. Titcomb: The lakes in the natural state, before the destruction of the forests, were all trout lakes. The Connecticut river was a salmon stream and carried the salmon up to all the smaller streams in Vermont. At that time there were salmon and trout. Of course, the salmon have all gone, and the lakes back in Vermont in which the trout have not been destroyed by the introduction of pickerel and that class of fish, are natural trout waters, with the exception of some lakes, where the surroundings have been entirely changed by the demolition of the forests, so that the temperature of the water has raised. While this method of fishing does not apply to your State here and your vicinity, it would apply, I suppose, in a State like New York, where they have lakes abounding in trout, and the same in the State of Maine.

Mr. Dickerson: I know some of the lakes in Maine have trout in them, and many of the lakes in Canada.

Mr. Nevin: I have tried to set a trap after the manner described, but the leaves would get in there enough to clog the trap and we could not keep it clean at all, then we used a fyke-net and drove the fish into it.

Mr. Titcomb: Didn't the pressure of the water collapse the fyke-net?

Mr. Nevin: No.

Mr. Titcomb: The fish would try to go over the top of the weir in the pond I speak of; in this trap, the trout would go up to the weir before the trap was built and you could stand there and see those trout jump up.

The Chair: We will now listen to a report of the Committee on Nominations.

Mr. Peabody: The Committee on Nominations unanimously report for officers for the coming year: President, W. L. May, of Nebraska; Vice-President, G. F. Peabody, of Vermont; Recording Secretary, Herschel Whitaker, Detroit; Corresponding Secretary, J. E. Gunckel, of Ohio; Treasurer, L. D. Huntington, of New York. Executive Committee—James A. Dale, of Pennsylvania; E. E. Bryant, of Wisconsin; A. N. Cheney, of New York; J. W. Titcomb, of Vermont; J. L. Preston, of Michigan; F. N. Clark, of the United States Fish Commission, and H. A. Sherwin, of Ohio.

On motion the report was unanimously accepted and adopted, and the nominees were declared elected.

The Chair: I want to say in behalf of one man on that list of officers, I think the name was meant for Whitaker, although it was not read so, that if that is the name, I am prepared to serve this society in any capacity they see fit to ask me to serve them. Of course, the office of Secretary means considerable work, and I will take it with the understanding that I have the co-operation of all the members present, in order that the report may be gotten out in a fairly reasonable time. The proof will be submitted to gentlemen as promptly as it can be got out by the printer. I shall wait for you ten days and if after that time I hear no response, I shall wait no longer, because the report had better come out in the shape it is than to be left over seven or eight or nine months. So you can be prepared to take your chances if you do not reply in ten days.

Prof. Birge: I have just had handed to me this morning's Chicago paper in which it is stated that the Natural History Building at Champaign, Ill., was struck by lightning and damaged ten thousand dollars and the collections, chiefly those of Professor Forbes have been damaged, to an estimated loss of $50,000. I move you that the Secretary be directed to telegraph expressing our sympathy with Professor Forbes and the loss science has sustained during this accident.

The motion was seconded and unanimously carried.

Chair: We will now listen to a paper entitled "Advancement in Fish Production," by Mr. W. D. Tomlin, of Duluth.

ADVANCEMENT IN FISH PRODUCTION.

By W. D. TOMLIN, of Duluth.

To secure the best results with the least expenditure of mental or physical forces, time and money are the requirements of the age we live in. In the summing up of the qualities that make the so-called benefactors of the human race, the ability to distribute wealth, though commendable, does not carry away the palm. The man who by a series of experiments, succeeds in producing results that increases the sum totals of natures implanting a hundred fold, is well along the road to produce a benefactor —if by increasing food supplies, creature comforts, or devising recreation as a means to relieve over-worked humanity is just as much a benefactor as he whom from his abundance, relieves the distress of his fellow creatures.

So, he who in the realm of nature, by careful cultivation produces an increase far beyond that which would be developed by nature's prolific handiwork, must in the same sense be considered as a benefactor—especially when by such means the comforts or well-being of large masses of the commonwealth are added thereto—and if by such means the masses can enjoy what has hitherto been a luxury, these benefactions are increased a thousand fold.

In such a gathering as this, where men whose minds are trained to expect large results, whose work is for the future, who are building for the future; men gathered from the toiling east with its busy hum of industry, men from the brawny west and its grain producing prairies and the land of the setting sun, meeting to confer on the middle grounds of the states bordering on these great waterways; where the busy toilers whose perspiring forms shape and fashion into elegance these monsters of iron that are building up the great empire of the west, these bringing the products of the busy looms of the teeming east and carry them westward, where meeting the produce of the prairies and the mountains and forests, at the docks and elevators of the unsalted seas, bringing back grain, wool, flour, lumber, iron, copper, silver and nickel; and here where the very air is resonant with the song "Iron is King," and the iron and steel age assert their supremacy; under such shadows we unite to consider the production of such food that shall form a part of the daily sustenance of the millions of these surrounding states.

It is on these great waterways, that produce such abundance of fish food, especially of such delectable and enticing flavor, that even the convalescent longs again for the repetition of the dainty dish. In these waters the "Namaycush" and "Coregonus" have their habitat; in the depths of these cold waters nothing putrescent contaminates—400 feet deep and 33 degrees to 39 degrees Fah'—conduces to a purity phenominal.

The advance in the practice of fish culture has become so popular, that even the toilers on these waters recognize in these fish hatching stations and their keen sighted employees, possibilities that are advancing the interests of even fishermen, and means to them more than a subsistence. From these men used to handling fish there has come scores of times the oft-expressed wish to understand thoroughly the best ways to increase the supplies of food fishes they handle; even the legislative committees at the last session were asked to consider some means whereby fish should be secured to supply the places of those taken by nets in international and boundary waters. Fishermen are said to be sordid, seeking only the present good; yet theirs is the desire to increase a knowledge of the taking of spawn that will produce the very best results; and tens of thousands would accrue, where now but hundreds are produced by the methods they employ

As to the fitness of such workers, there can be no question, inured to cold and exposure, hardy toilers, indefatigable, persistent even to face fearful odds—absolutely proof against that bane of all landsmen, "sea sickness," they will still face every danger, even though beaten back by winds and storms.

There are no more amusing sights than to see a man trying to strip a vigorous squirming fish, at a time when an irresistible impulse comes o'er the individual to balance his accounts by "feeding the fishes."

I have known such fishermen in the excitement of a rush, when a net full of ripe fish were secured, wade in almost waist deep into waters positively chilling; and in their eagerness to take all the eggs that were possible to secure, to lift their hats and wipe away the drops of perspiration from across the forehead.

A gentleman quite prominent as a successful culturist in his work said, but a few years since: "I would rather have a good fishermen possessed of good horse sense, and let him get into a net of fish that we wanted to strip from, than any landsman I could ever train; they will endure harder work without fatigue, do not suffer, and once get them interested will strip with more intelligence and care than any man I could ever train; they make the boss strippers; no man can successfully strip a large trout when his teeth are chattering, and his entire body chill and numbed with cold."

An employee of a hatching station who has secured millions of eggs has said: "I always prefer a fisherman for the work, where they take pride in it as some do; they have always secured more eggs than I could myself, because of their rugged physique and physical endurance. I have had the best results from eggs thus stripped by men who have followed the fishing business for years, and know that some of them have stripped eggs from the Lake trout for the past ten years, when ripe fish are found in their nets."

This idea has become engrafted on the minutes of the association I represent, that its sentiments are voiced in suggestions to the legislature recommending, "That every steam vessel or tug engaged in fishing with nets should have provided a bucket that should be kept ready for use, and for this purpose alone; so that when lake trout are caught when ripe, and the eggs are exuding from the vent, that such fish should be stripped, and that such stripped eggs should be milted with the first ripe fish caught, and the bucket then set aside in a safe place to allow the eggs to become fertilized.

To better insure such fertilization without possibility of endangering the eggs by the introduction of deletrious matter, a piece of rope made like a swab (like sample furnished) was wetted and soaked, then used to stir the eggs, thus permitting the thorough circulation of the fluid amongst the eggs without putting dirty hands into the bucket.

This has been done for years, and singular though the process may be, yet the eggs deposited in the grounds the fishermen knew of, have produced the very cream of lake trout in the last few years; these fishermen are not so egotistical as to assert that this is the best way to secure the production of fry, but they do claim that even twenty per cent. gained is better than to throw all the ripening eggs into the water, and thus destroy all possibilities of a return of nature's provisions; the experiment has proved worth a trial. Even the busiest of the men would watch with interest the changing color of the eggs, the firmness and stiffening of the eggs after the thorough commingling of the life-giving properties, and when the mass was quietly slid into the water the comments were: "There goes another batch that will come back to us or some of us within two or three years."

If such work can be done by men in such a hurried manner, and by slippery fingers without being trained, and will produce the results described so that fishing has kept good on these grounds for fifteen years, and has been up to its standard of former years, what results would be accomplished if fishermen were instructed by men appointed for that work, and the mass of fishermen intelligently instructed and encouraged to assist the state or national government in this great work.

The idea has grown into circulation that fishermen have no thought beyond the present moment and would not use such methods after they had been trained for effective service.

Has it ever been tried?

Again; in all the Fish Commissions of the states surrounding these great lakes has ever a member of the fishing fraternity been appointed to the office of fish commissioner?

Has any attempt been made to secure laws that are practical in their working so that the laws could be obeyed?

Have means been tried to secure a better interest in the laws made to protect fish by securing a united action of fishermen for the support of such laws?

Contra; the men who are supposed to enforce the laws—the Game and Fish Wardens—have made the fishermen the spoils on which to recoup them for their work; seizures have been made by men having a show of authority; and though the injustice of the charges have been proven, yet no satisfaction was given as to freedom from such legalized robbery; men have been threatened with arrest, their fish seized and sold; the men told to quit fishing, just because a pompous individual desired to air his little authority.

Such treatment does not conduce to any love for a fish commission nor its officers.

If any desire was shown to consider the costs of such an experiment as herein described could not a sum of money be spared from the commission work of these states, or an allowance made from the funds of the United States Fish Commission.

The experiment tried one season would settle the question and all the men would readily "catch on," and on the waters of these great lakes lakes there would come an army of strippers that would render to the Superintendents of the Fish Hatching stations valuable service at any time when needed.

From an experience of years of acquaintance I am in possession of data that has never been secured, but from the fishermen always freely given. Since the Duluth Hatching station has been doing good work, the fisherman's interest has been aroused, and when anything of especial interest occurs their secretary is put into communication; when any large catches of whitefish, lake trout, blue fin or long jaw occur, reports come in. Last fall a short message came to me: "A splendid run of whitefish had been seen in Siskowit Bay on the Wisconsin shore, the first seen in years, and they had spawn in them." It was too late at that time to report because the season was advanced and navigation was closing; from Isle Royale there came a report from one of the most reliable and intelligent of our fishermen: "A large school of whitefish are working on the reef at Fish Island; there are thousands of them and were there some days, and are spawning." The water is so clear on this island that the movements of fish can be watched at depths from fifty to sixty feet.

Arrangements are being made to report such matters as these so that the Hatching station can secure eggs if they so desire, but when fish commission employes go to a point when fish are spawning, and plays sick because the waters are a trifle rough and he suffers from an attack of qualmishness, and then returns and reports that he could get no eggs because there were no ripe fish, fishermen quickly estimate the cost of such incompetence.

(I am in a position to know that several boxes of spawn were secured by fishermen, while the expert was laying under the brush hugging a whisky bottle.)

If the question of expense is to be considered, and the percentage of profit or loss, suppose we look at the possible water areas that should be cultivated. It has been often quoted in past years in the commission reports of different states that in some portions of the world that an acre of water is made to produce as much wealth in fish food as an acre of cultivated land produces.

In the chain of great lakes backed by the falls of Niagara there are 62,500,000 of acres of water. Suppose we adopt this formula, it would read:

Area, multiplied by acres, multiplied by products, multiplied would equal and read $A \times ac \times pro = \$748,000,000$.

The three lakes producing the finest of whitefish estimated by this formula would read:

Lake Superior Area×ac×pro' would equal......$239,000,000
Lake Michigan Area×ac×pro' would equal......$153,940,000
Lake Huron Area×ac×pro' would equal........$132,000,000

These figures are given in round numbers, and are based on the repeated calculations of cultivation of water areas where water is made to produce wealth.

Let us suppose that the estimated consumption of fresh fish is 150,000,000 pounds annually, and that there are imported into the United States 100,000,000 pounds annually. The estimated value of these commodities would be $7,500,000. What a small percentage of profit in comparison to the possible opportunities for food production; a comparison between about $750,000,000 and $7,500,000.

To supply an existing deficiency of ten years ago the United States Commission expended on building and apparatus on these lakes $62,000.

Its operating expenses are........		$20,000 annually
It is possible that the states have expended	$50,000	$30,000 annually
This is equivalent to an expenditure of $112,000		$50,000 annually

to secure a money value of about $7,500,000.

If we compare these values of the water products with the water products in countries whose food is largely fish and where fish are cultivated the result would be a comparison of $750,000,000 to less than $8,000,000.

If the 150,000,000 pounds of fresh fish taken in American waters are valued in the ratios of fish value of other products the ratio would be $4,500,000.

Suppose we estimate these fish values, numerically 75,000,000 of fish, and if it was possible to instruct men and interest them to do the spawning as suggested, and if 30,000,000 of fish could be thus spawned, would not a possible 250,000,000 fish be a fair percentage for the experiment?

These figures may seem optimistic and far-reaching, but they are within the limits of computation and certainly when we know the vast areas of these unsalted seas and the possibilities of their production they cannot be thought visionary.

It has been well said: "*Through the Niagara river speeds the overflow of the four upper lakes, where the majestic St. Lawrence carries it off to the ocean. The shores of eight of the United States and two of the vast provinces of Canada are washed by these waters. A large fleet plies between these harbors, carrying greater riches of food and minerals than any other lakes or seas in the world. Nature has lavished her most beautiful scenery on some of the shores and manifests herself in the famous water-falls in her most imposing grandeur. Lake Superior is a little larger than Lake Victoria Nyanza, and is therefore the largest fresh water lake in the world.

Mr. Vodel, of the Western Society of Engineers, has well said: "That the catchment basins of about one-half the globe center in the territory of these great lakes and the half of these areas are fresh pure water, the purest in the world." We are obliged to admit these facts; then if admitted, what are the possibilities for fish production? Illimitable!

For every dollar invested, either by the national government or the state commissions, there are probabilities of large returns; and when in the coming years these fish commissions shall extend a hand to assist the men to whom of all others comes a knowledge of the resorts of these deep water fishes, the spawning grounds, the feeding grounds; the very nature of the food laying along the reefs on which these fish feed, and whose daily avocation brings to their eyes the bottoms of these lakes, from these men information valuable to those engaged in producing the millions of fish fry to be returned to these waters, will be readily secured and assistance extended.

Let the state commissions, or the United States commissions, accord to these men the courtesy that belongs to manhood, the respectful consideration one man owes to another, a recognition of right and justice; let a showing of sympathy be extended to them instead of all law; let some encouragement be shown by an appeal to that side of humanity that melts under the genial sunshines of a brotherhood of common interests, and these fish commissions will have no more effective assistants nor earnest helpers than these same fishermen.

Give them laws under which all men can live, and they will respect and obey law, and if a few hundred of dollars are expended in effective education in the manner suggested; then along these lake lines will come a body of men, who from their crude instrumentalities yet dogged perseverence will assist to restock these lakes with the very fish that should prove a greater inducement to intelligent fishing, and a mine of wealth richer by far than the glittering quartz along the boundary line of Minnesota, and perpetuate a fish that serves as the daintiest tid-bit that ever a convalescent coaxed back a capricious appetite, that most famous of all dishes a Planked Whitefish.

Mr. Clark: I want to refer one point in that paper. He spoke of some five hundred thousand or a million dollars being expended by the United States which I think is too much. Won't you please refer to your figures again, Mr. Tomlin?

Mr. Tomlin: "To apply to the existing deficiency the United States Commission has expended $62,000—"

Mr. Clark: Have you got your figures authoritatively?

Mr. Tomlin: I got them from Commissioner Brice.

Mr. Bower: I was in Duluth and had charge of the putting up of that hatchery. The contract for the building, I don't remember exactly what it was, but it was between $10,000 and $11,000. That is all that was expended at that point.

Mr. Tomlin: That is on Duluth alone. I said the Great Lakes.

Mr. Stranahan: There must be some mistake somewhere You take Alpena and Duluth and that is all there is substantially. There is a station on Lake Ontario, however.

Mr. Bower: Mr. Tomlin has drawn an entirely wrong conclusion from the figures I used. I do not claim because we hatch five hundred to a thousand times as many fish as nature does from the same number of eggs that we are going to get from five hundred to a thousand times as many adults from them. There is, of course, an immense waste. I think Prof. Reighard showed this morning that it would be absolutely impossible for the waters of these lakes to support such an amount of fish. They would mostly starve to death. It is fair to presume that a hundred years ago, before fishing was commenced in the Great Lakes, they held all that the waters could possibly support and the numbers of whitefish then in the lakes or of the lake trout or other valuable species was certainly below the number Mr. Tomlin mentions.

Mr. Dickerson: I would like to ask Mr. Tomlin how the commission can do injustice to the commercial fishermen by seizing their nets if they are fishing legally? So long as the commercial fishermen are respecting the laws of their states they are not disturbed.

Mr. Tomlin: That can be explained easily enough. Wisconsin and Michigan had a law that no net should be set within three miles of shore lines—

Mr. Whitaker: You are mistaken about Michigan, as we have no such law.

Mr. Bell: You are mistaken about Wisconsin also.

Mr. Tomlin: In each of these states nets were seized that were within the limits.

Mr. Dickerson: They have in Michigan in two or three cases, seized nets and destroyed them, but in every case there was a violation of the laws of Michigan. The fishermen did not respect the laws of the state. There is no question in my mind that if the commercial fishermen would strip their fish and replant the eggs it would be a help not only to the commissions but it would go a long ways towards helping to maintain our present fisheries and again restock the waters. But I am afraid it would be a hard matter to educate them up to it. In 1885 the whitefish product of Michigan was almost 9,000,000 pounds. That product has decreased at the rate of over 1,000,000 pounds a year until in 1895 it was only a little over 3,000,000 pounds. Now, the commercial fishermen of Michigan have seen their fish slipping away from them and yet they come to the legislature and ask that the State of Michigan pass a law compelling them to do what they know they ought to have done, and in no single case have they stripped a single fish or done anything towards preserving the waters. It seems to me it ought to be to the interest of the commercial fishermen to do everything that we have recommended.

Another thing, if we have a close season during the spawning season, such a thing as that would not be necessary. We have just passed a law in Michigan making a close season. The fish now will strip themselves and if the commercial fishermen in all the states bordering upon the Great Lakes would help to enact a law protecting the fish during the time of their spawning, nature will then do what you ask the fishermen to do because the fish will lay their own eggs instead of being stripped. I can see readily what a great benefit it would be if what you suggest was performed but when men won't do it in their own interests when they have declined repeatedly for a dozen years to do it, I cannot see how under the sun the United States government or the State of Michigan or any Fish Commission can educate them to do what they know they ought to have been doing for the last twenty years.

Mr. Nevin: I will say for the last eight years we have had laws in relation to the fishermen impregnating the eggs and planting them back on the spawning beds. In the last eight years we have hired men and used on an average three or four hundred dollars a year to put men on tugs to plant them back on the spawning grounds, and we send them blanks for them to fill up and we keep accurate data. The third year after we planted these eggs the fishing showed great results, especially with small trout on these beds, and those fishermen are the greatest friends we have got.

Mr. Dickerson: Have you a close season law in your state?

Mr. Nevin: I don't beleive in a close season. We can accomplish more without, by having the men strip the eggs and plant them back on the spawning grounds.

Mr. Dickerson: Do you find it necessary to train men to do that? Were not these fishermen sufficiently versed in the trick of stripping the fish to do that?

Mr. Nevin: Oh, they can do that, certainly, but they don't do it unless they are compelled to.

Mr. Dickerson: What I speak of is the necessity of passing a law compelling them to the very thing they ought to do to protect their own business.

Mr. Nevin: We have the law now.

Mr. Bower: A little while ago while I was reading my paper, Mr. Nevin made the statement in reply to my statement that I did not think more than one in every five hundred to a thousand eggs were impregnated naturally that I had got it too high; it was not one in a million. Now, if that is so, what is the use of putting them back; why not take them and hatch where they are protected? Then again, you have not got to depend upon the certificates of your fishermen. What do you want to put them back and let them be lost for?

Mr. Nevin: They would not be impregnated naturally.

Mr. Bower: There is a considerable percentage of impregnation naturally.

Mr. Nevin: There is very little among whitefish. In fact, if there was, our lakes would not hold all the fish. We took this year 190,000,000 of pike eggs from 3,000 and odd fish and just think of it, the number of pike eggs taken from those fish, when you come to figure up the quantity in all the lakes, it would figure up into the hundreds of billions.

Mr. Bower: We can get a larger percentage of fertilization but we know there is no spawning ground of any kind of fish that is not also the feeding ground of some other fish. Now, why let those go to waste in that way?

Mr. Nevin: I agree with you there.

Mr. Bower: If fish are spawned artificially why not go a step further and secure better results by protecting the fertilized ova until hatched? That is the point.

Prof. Birge: There are certain limits to the size of your hatching houses. The cost of hatching and caring for your fish until they are ready to plant is considerable. By the expenditure of a few hundred dollars you can put back an enormous number of impregnated eggs which need not be taken care of.

Mr. Bower: On that point, I will say there has never been a season, certainly not to my knowledge, when all the hatcheries of the great lakes have been filled. They never have been able to fill them all in one season yet.

Mr. Nevin: In relation to Lake Ontario, I know for the last twenty years there have been very few fish taken from the fact they are not there. At the same time we know millions of eggs are laid there every year, the fish lay their eggs there but they don't seem to increase. There has been no fishing there in twenty years.

Mr. Dickerson: They have fished them out in the same way they are fishing out our lakes now. I say a close season is of no benefit.

Mr. Davis: Is it not a fact that in Lake Ontario, as well as in other lakes that the fish have been caught so small; that the majority of fish have been caught out before they have arrived at the age of reproduction?

Mr. Nevin: That is the trouble around all the lakes.

Mr. Tomlin then read extracts from letters he had received from fishermen and gave data which he had obtained from mixing freely with the fishermen, which he thought was obtainable in no other way. He said if we could only induce the fishermen to impregnate a thousandth part of their catch, it would be a great saving. He expressed great confidence in the work the fishermen were doing.

He said the spawning season usually took two weeks and with half a dozen men with $360 the whole work could be done in a large area.

Mr. Dickerson: It seems to me every fisherman ought to have interest enough to impregnate those eggs and put them back without expense to the state or general government.

Mr. Tomlin: You must remember these fishermen's fingers are all thumbs. It is a graphic expression but I almost split my sides laughing to see them handle the fish while they were spawning and one big fellow, taller than myself, was in the waist of the boat at one time trying to strip a fish, and the fellow "kicked" him, as he called it, just about the time he was stripping him and he came very near falling over the sides of the boat, and would have done so if I had not been there. The fish went over and his eggs all in its till. So, it is really a difficult matter to get these men to know just what to do. Mr. Wise, of Duluth, has three men working for him all the time.

Mr. Clark: I have been very much interested in this discussion but from my experience, having taken upon the great lakes whitefish and lake trout eggs in large numbers and had a wide experience, probably as long as any of the members, and perhaps a little longer, I do not see where these gentlemen's arguments come in good at all, for this reason: I failed to find a place where ripe fish are caught and put in the boat, where the eggs are not saved. If there are any such spots, if you gentlemen will tell me where they are on the lakes, I will have men there this fall to save the eggs. For four seasons at least we have been short of eggs. We have some difficulty to find places where whitefish were caught that were ripe. All on Lake Huron, Lake Michigan on the east side, and at the Detour there has not been a single spot fished where the United States Fish Commission has not had men in the boats, unless the Michigan Commission or the Wisconsin Commission had engaged the boat. I do not see how there are any whitefish eggs wasted.

Mr. Tomlin has spoken to us about the great number of lake trout eggs that are on the decks of the boats. I want to say it is the same with trout eggs as with whitefish eggs. Two years ago I gave the New York Commission two or three boats that we had engaged. They could not find places to get enough eggs. Now the waste of eggs from fish that have been caught is not so great as claimed. Of course there is a waste with unripe fish.

Dr. Parker: This interminable fight that comes up almost every session when anything is said about protection has lasted through my whole experience with the commission of some 14 or 15 years. There seems to be antagonism existing between the commercial fishermen and the Commission in some way. It is hardly definite enough to locate, but it is something that ought not to exist. It is just as necessary to catch fish as it is to plant them, and that it what we plant them for. And it seems to me when the commercial fishermen can understand this, there will be nothing really antagonistic between them at all. We had the same fight at Lansing when I was on the Commission and parted worse friends than we were when we met. It seems to me as though some broad form of education might be had of some specific sort—I cannot say legislation for they won't take it—we never have been able to propose any legislation but what hurts somebody somewhere; and so it seems as though if we could take a broad ground and in some way bring about a better understanding it would be better. We all know very well, and especially the fishermen who have the largest interests at stake personally, what is necessary, and it seems to me that we might formulate some broad plan by which the commercial fishermen and this association and kindred associations can bring about some way by which fish can be protected it would be a good thing, if it is possible, if not let us give it up.

Mr. Stranahan: So far as whitefish are concerned, during the seven years I have been at Put-in-Bay the eggs lost have amounted to practically nothing.

Mr. Nevin: In Lake Superior we have been planting fish and I can truthfully say there were more whitefish caught last year than in the last four years put together. We have there the mile limit and last year they were fishing with seines and they caught as high as ten or fifteen barrels of small fish, but of course we nabbed them in time. As long as they catch the small ones we cannot expect to have the big ones.

Mr. Dickerson: That is just what they have been doing in Michigan. We found they had been catching whitefish at Mackinaw that took eight to a pound. The size of the mesh has grown smaller, they have kept getting the mesh down and down and we have made efforts in the Legislature to correct that. We got together this year at the Legislature and we agreed on a bill. The commission and the commercial fishermen, the pound net fishermen and the gill net fishermen got together in a room of the House and every fisherman present and the Fish Commission represented by Mr. Davis and myself, drafted a bill right there, written by the clerk of that committee, and every fisherman agreed to it and they all went home and agreed to help pass that bill. Within forty-eight hours some of those same fishermen were back there fighting that bill tooth and nail and continued to fight it until the end. We also had a bill in the Legislature regulating the size of the meshes of nets. To show you whether they honestly wanted the bill to pass or not—I am speaking at least of some Michigan fishermen—our bill prescribed the size of mesh of pound nets *as used*, so when you found a man with an illegal sized mesh it was not necessary to go any further to establish the size of the mesh, but they wiped that out and made the bill read as to size of mesh "as manufactured." Under that act, if you catch a man using a two and a half inch mesh and he produces a bill showing he purchased it for a three he is safe. He can have it billed from the factory at three-inch mesh and nothing can be done with him. In order to not violate the law they would order a two and a half inch mesh and have it billed at three inches, and when they were arrested they would go on the stand and swear they bought the legal size, as manufactured, and produce their bill in support of it. Men admitted right before that committee they knew of cases where they had ordered nets at two and a half inches and had them billed at three.

Mr. Whitaker: Michigan undoubtedly typifies to a greater extent to-day the state against which the antagonism of the fishermen has been aroused unjustly, more than any other state in the union. We have constantly, as fish commissioners, brought the product of the hatcheries up to the highest point. We have been putting out into these waters for the last five or eight years something like 150,000,000 to 160,000,000 of live whitefish. We are doing it in the interests of the public, not in the interests of the fishermen. Incidentally the fishermen reap the benefit but the commission inaugurated this work for the benefit of the public and for the preservation of a great food supply. We have been in possession of the causes that are to-day slowly and surely killing the great lake fisheries like a creeping paralysis. We to-day know that that paralysis attacked Lake Ontario thirty or forty years ago, and we know that that end of the spinal cord has been absolutely paralyzed for the last fifteen years. Fishermen used to say there what they say here, if any interference is attempted "you are ruining our business," and they are permitted to go on in their own way, without any legislation and they are accomplishing their own undoing. Their nets and boats are rotting on the shores of Ontario. Their avocation has passed away. never to return, in all probability. What are we of the fish commission confronted with on these great lakes, to begin with, taking the life of the commission as of twenty years of age? With the fact that unlimited fishing has been done from the very earliest time when the season opens and the nets can be set, until it closes by the storms of fall.

As honest fish culturists, we believe we are intrusted with a public duty; that we are not performing that public duty by simply blindly hatching and putting fish in the water. We feel that we must take into consideration the possibilities of the ultimate success of our work. If we propose to go on year after year here and do nothing but plant fish and print the figures in reports, we ought to be bounced out of office. We have a further function to perform. I say to you such work is a misuse of public funds that ought not to be tolerated by any honest community in these United States.

Commencing in 1885, the first and most complete statistics of the great lakes ever taken by anybody were taken by this board. There was then a lapse of five years, when the reports were imperfect. A law was passed that every fisherman should report his catch to the superintendent of the commission in this city. They did not do it. We went to work, beginning with '90, sending out to every fishing station of these lakes a man who has conducted that work ever since, and a man who is absolutely indefatigable in this work, and he gets the statistics and he gets them all. So when we speak of the condition of Michigan's fisheries, we are not speculating on what exists in Michigan, but we are talking of what we know to be the fact.

Now, we have gone to the Legislature and said this: Gentlemen, here is the iniquity of this matter. You protect the game, the deer, the birds and everything of that kind, surrounding them with proper protection during the season of reproduction yet the state does not invest a dollar in their propagation. It is a sporting business. But here is a great commercial fishery that with all our persistence we cannot have protected even to prevent the catching of immature fish, to prevent interference with the spawning fish at the time they are dropping their ova and attempting to perpetuate their kind. We have been met at every turn by the opposition of the fishermen who, if they would take counsel of their own experience, would know they are blocking their own interests. That is what we are after. I say to you now, as has been said here to-day, that the adult fish should be caught for the food of man. They ought to be taken at every season of the year, except at the time of reproduction for that is what they are there for. But our returns show that more than a fourth in weight, not to say anything of number of fish caught in this state, are immature fish that have never come to the spawning age. Add to that the fact that you catch the fish on their spawning bed (that are as well known to fishermen as they are to the whitefish themselves), and you can see they are burning the candle at both ends all the time and the time must speedily come when the fisheries will be ruined. What we stand for in Michigan is the protection of the public interest in the fisheries and their maintenance. Public sentiment has not been aroused but there is a day coming when it will be. I hope not too late. There are many commercial fishermen, however, who sympathize with the idea of protection. But these men are controlled by the large dealers and buyers of fish, who never fish theselves, but who are making money out of the business. The result of it is when a bill is introduced in the Legislature, petitions are sent in signed by Tom, Dick and Harry and when it comes up for consideration in the Legislature the legislator is frightened and afraid that he will antagonize 200 fishermen in his district which may have 50,000 people in it, and he thinks his policical aspirations for the future may be damaged if he antagonizes them.

Let us see what the condition of the fisheries of this state is? In 1885 there were caught 8,143,626 pounds of whitefish. Now, the returns of 1885 did not begin to be as complete as they were in 1891, but that is in favor of the other side of the argument, if anything. In '91 the catch was 8,110,000 pounds. In 1892 the catch was 6,347,535 pounds; in 1893, 5,345,800 pounds; in 1894, 4,496,755 pounds, and in 1895, 3,353,187 pounds, showing a falling off of 5,000,000 pounds. You will observe in looking at this chart, there is not a redeeming feature in it; that it has been a continual decrease, and it is not that feature that I would criticize alone if it showed an increase occasionally. Now they say you are planting whitefish, but they are decreasing and you do not do anything with trout and they are increasing. That is not so, but that is what they say.

The decrease in lake trout has been steadily going on during the same period. In 1891 there were 9,132,770 pounds; in 1892 it was 8,859,000 pounds; in 1893, 8,859,500 pounds; an increase of about a hundred thousand younds that year, less than that a little, but about that. In 1894 it went down to 7,291,295 pounds; in 1895 it went down to 6,293,543 pounds. Now, let us take the quantity of twine fished and see how that increased during the same period. Let us see the devices by which they were captured. If the fish were more plentiful the quantity taken ought to have shown up a little better. Here is a table showing the number of nets in use for the same period. In 1885 there were 25,859 nets of all kinds in this state. In 1891 there were 36,000. (I will leave off the odd figures). In 1892, 38,514; in 1893, 42,075; in 1894, 40,452, a decrease of about 2,000 lbs.

What we say to you is this, as Prof. Reighard said in his paper this morning, it is not as though these fish were evenly distributed over the lakes. They are at one season of the year on feeding grounds and at another period on spawning grounds. These nets are not set evenly over the lakes, and you can comprehend their enormous length when I tell you if they were put end to end they would reach from Detroit to San Francisco and 250 miles into the Pacific Ocean. What chance is there for a single guilty fish to escape? It is all right enough if they would fish with the legal size of net and catch merchantable fish. Nobody would complain. In this connection I would like to read from a letter from a seller of twine, showing how the meshes have been contracted in the last few years. I am not at liberty to disclose his name but he knows what he is talking about; he sold these nets and that is why he knows.

My informant says that the contraction in size of meshes of nets since 1870 or thereabouts, when they were fishing twine in gill-nets of $4\frac{1}{4}$ inches, has diminished as follows: $4\frac{1}{4}$, $4\frac{1}{8}$, 4, $3\frac{7}{8}$, $3\frac{1}{2}$, $3\frac{1}{4}$, $3\frac{1}{8}$, 3, $2\frac{7}{8}$, $2\frac{3}{4}$, $2\frac{5}{8}$, $2\frac{1}{2}$, $2\frac{3}{8}$, until now they are down to $2\frac{1}{4}$ inches.

If the fishermen would come to the front and acknowledge what they know to be the fact, that the fisheries are bound to go unless present methods are changed, if they would extend a hand half way in this work, we could succeed. We were punished by the commercial fishermen this winter, and our appropriation was badly cut simply because we did our duty. I want to say that we will not be deterred from doing our duty, however, because of that. This thing has not significance alone for Michigan. Every state represented here upon the great lakes is concerned in some degree with the very thing that has been done here, because you are interested in the results of fish planting and what shall be done in the future. What we proposed in the way of legislation was in no way intended as a punishment to anybody, and we have never proposed such a measure. We say the fish are for the public, and the fisherman is the medium through which they should be taken. Nobody objects to the taking of grown fish, but we say they are exercising a privilege and not a right in fishing in the great lakes, and that that privilege should be exercised with a due regard to the maintenance of the fisheries in the public interest. They belong to the people, and it is not a question of fish food for this age alone, but it is a question that affects the generations that follow us, and they will feel the influence of the present waste. Are you, gentlemen, prepared to say that these great channels of navigation shall serve only the purposes of floating ore from Escanaba, lumber from Saginaw, copper from Keewenaw, and the products of the prairies of the great west? Are you willing to simply make these lakes a channel of navigation, or are you going to have these vast waters food producing? Are you going to meekly consent that this may be done without putting up your protest? You know you are engaged in an undertaking that under present conditions can never by any possibility succeed. That is the question that is before us. I say it is an important question. I say no body of men, I care not who they are, can ever deter me from doing what I know is right.

Now let me speak to you as to the attitude of these fishermen. The state, in its wisdom, said we will attempt to stock these waters, and what assistance have they received from the fieshermen? If you go on the spawning grounds for ova you have to pay for the ova you collect, and in addition to that something over. If you go to plant fish they will enjoy the privilege of taking, by pre-emption or some other way, you have got to pay from five to thirty dollars to get those fish planted on the spawning grounds. Now, what are you going to say to this? I speak to you warmly, because it seems to me this is a matter of great public concern. I say to you it is a calamity to destroy the hatcheries for commercial fish such as Michigan has, simply because sordid men do not want to be interfered with; simply because they say if we can only get rid of the Michigan Fish Commission, we are at liberty to work our pleasure on these fisheries. That is the position, baldly stated, that we have to confront. For fifteen years of the best activity of the men I see about me here, we have devoted our energies and thought to building up here in the interests of the public, and incidentally for the benefit of the fishermen, one of the largest whitefish and lake trout hatcheries there is in this country to-day, and now we see it destroyed because the fishermen do not want to be controlled.

The greatest loss is sustained in the taking of small fish. As I said before, fully one-quarter in weight of the catch is of young fish, too soft and immature to be shipped to market fresh, and they go into the herring catch and are sold for a cent a pound. If those fish were left in the water for three years they would sell for three or four cents a pound at the lowest price, while they now sell for about one and a half cents per pound. Now, that is of concern to the public, not only in Michigan, but in every other state on the lakes, and this attempt to ruin an industry of this kind should be stopped.

Mr. Nevin: We have eleven tugs fishing in our waters. There are three hundred miles of nets out in that lake there every day in the year.

Mr. Tomlin: Twelve years ago, I moved before such a body as this a resolution that we ask the society to go to work and secure proper protection. The chairman that year, and the gentlemen who has recently presented his resignation, one of the members of this society, fought that resolution to the bitter end, and it was only when I appealed to such men as Dunning, of Wisconsin, and Fairbanks, that power was given that association to act. I helped to secure the first ten thousand dollars that went towards the Duluth hatchery. From that time on the interest at Duluth, and I will say on Lake Superior, has increased in fish culture. I can only regret that I have aroused so much opposition, yet I am very glad indeed I brought this matter up for discussion to-day. Mr. Whitaker has certainly given me some facts I will carry home with me. The record on my books shows since 1886 there has been an increase in the meshes of nets in Minnesota. They run from four-and-a-half-inch mesh up to five inches. The majority of the fishermen on the lakes are fishing with four and three-quarters and five-inch mesh, and I honor A. Booth & Company, and I want to tell you, gentlemen, that they absolutely and positively refused to buy any whitefish of less than two pounds dressed weight.

I think the very action taken by this Society to-day in its meeting calling for a committee to be appointed from each of the States for the consideration of this question is going to solve the whole matter, and this Association will still take the lead and recommend to the Legislature of each State something that will prove a solution of the whole matter.

Mr. Whitaker: I want to say one word in that connection. Perhaps Mr. Tomlin did not know it, but along last December, in the very water he speaks of, we received a report from Messrs. A. Booth & Co., from their fishery at Isle Royal, showing that two-thirds of their catch, and I am stating it safely—I think it was more than two-thirds—in weight of whitefish taken were No. 2's and under—fish that had never spawned in the world. It was their own man who made the report and sent it in here.

Mr. Nevin: They do not give you the full report of the amount of fish they catch, anyway. A year ago I saw a statement, which they showed to me, saying that this is for you to use and nobody else, and it differed materially from their published reports.

President: While we are on this general subject of the protection of the fisheries, we will have read a paper from Dr. Bushrod W. James, on State Laws for the Uniform Protection and Propagation of Food Fish.

STATE LAWS FOR THE UNIFORM PROTECTION AND PROPAGATION OF FOOD FISH.

By BUSHROD W. JAMES, A. M., M. D., Philadelphia, Pa.

The extended superficial area of the United States, with its waterways permeating far into the interior, from the Atlantic to the Pacific Ocean, and the Gulf of Mexico, warrants the protection of these streams to prevent the annihilation of the fish, as well as for their extended propagation and growth, as very great values may be obtained in a few years by the operation of judicious and well-considered legal enactments for the protection of the streams in which the fish are placed when very young, and for clearing and keeping clear these streams from all devices which tend to the capture of the fish before they have had opportunity of spawning in the waters which they frequent.

Most of the States into which streams enter from the ocean have already passed laws looking to this need, and New Jersey and Pennsylvania, being border States of the Delaware River, many years ago entered into a compact to protect the stream in this manner, and keep it an open waterway or highway, and as a result the money value of the fish caught in that river is increasing annually many thousands of dollars. The Susquehanna, which passes through Maryland and into Pennsylvania, has not as yet received the ample protective laws needed, and the result is that the money value of the food taken in the way of fish from that stream has been at a standstill for years and, in fact, has been diminishing in value.

The Delaware River rises well up in the interior of the State of New York, so that we have the States of Delaware, New Jersey, Pennsylvania and New York all interested in this valuable waterway. What is said of this eastern stream might be said of western rivers flowing into the Pacific Ocean, and we might likewise add the great aqueous artery of the continent, the Mississippi, and its branches, which, no doubt, might contain many million dollars' worth more of food fish than they now do; and yet, each State having the right to make fish-protective laws, might find the laws quite annulled by other States through whose borders the streams pass, the more northern States being at the mercy of those far down the river whose laws are not enforced, and where money can be made by catching food fish in great numbers for the market, to their probable annihilation in a few years.

We could hardly expect in the rapidly flowing streams of the mountain regions of the far West to successfully protect a very great variety of the food fish; but even those should be thoroughly protected by adequate statutes by the Legislatures of the States through which these mountain streams run. Many lakes, however, occur in some of these States, even in the mountain sections. These should be protected, and not only that, but they should be stocked with the best varieties of edible fish, and of the kind that will not destroy their companions.

This condition of things existing in almost every State of the Union, it will readily be seen how great the need is for uniform laws for food-fish protection throughout the entire country.

I would here urge that this national society, composed of Fish Commissioners and members from the various States all over the country, consider well this subject of legislative action to this end.

The resolution we adopted last year, aiming at the harmonious action of each State with its neighbor in the interests of general propagation and protection, was in the right direction, and any action from that committee should be supplemented by a general support on the part of the American Fisheries Society.

I do not mean to exclude the interests of the Great Lakes during the past few years for propagation purposes, and with partially good results; but they can never carry out the full intent of those who have the general good of the community at stake in this matter of supplying a most valuable and delectable form of diet for the towns and cities where a market can be had for this form of food.

Good laws should be enacted all along the Great Lake bordering States, and they should be thoroughly enforced and a rigid observance of them continually maintained; and under no circumstances should the small fish be caught before they are of a size to have spawned at least once.

By this method an amply sufficient supply of growing fish would constantly fill the waters of the Great Lakes along our northern border. Canada should unite with the United States at all points to help fill the lakes along her shores, and by this mutual action her revenue from this one source alone would be greatly increased, as well as that of our own States.

Nothing but good can be obtained from a uniform, harmonious protection maintaining all interests in this way. In this age the depredating, contentious, "grasp-all-you-can" principle should be relegated to oblivion, and unity of purpose will redound to the mutual advantage of all parties living along the borders of these great international highways and receptacles for food-fish supplies. Kindness and mutual reciprocity usually work to the advantage and interest of all parties concerned; and in this matter, if in no other article of commerce, we should aim to obtain these uniform concessions on the part of all States and countries adjoining each other.

In regard to uniformity of laws for the streams running into the interior of the country from the large sea, lake or gulf areas, I believe that the United States Government should formulate a protective plan of extending not only over the commercial end of the streams, but that laws protecting the tributary divisions of those streams should be passed, and the enactments kept fully operative. I maintain that there is strong ground for governmental supervision of these waterways, inasmuch as the local laws of one individual State cannot be enforced in the adjacent commonwealths, and the great difficulty which has existed and which it is almost impossible to overcome, as to how these various State enactments can be made entirely harmonious and uniform, it seems quite a necessity to resort to the method of inter-state protection by national enactment, and especially over all the national waterways.

I would like to impress this point still more forcibly from another standpoint, and that is that it is the duty of the government to do all in its power to advance the interests of the citizens of the United States, and enact laws which will be for their general good, and add to the prosperity of the country. The addition of many million dollars' worth of food in this shape to the country is certainly not only laudable, but it is quite important for the government to provide this increase of provisions, and the increased value which would thereby be secured.

These laws should be enacted at a very early day likewise, because of the reckless impoverishment which is going on all over the country, in this as well as in various directions, such as forestry interests and the valuable land grants which the government and the people have so lavishly turned into the hands of reckless speculators.

It is not too late to reform this matter, and measures should at once be instituted for the uniform codification and adoption of the best laws that can be thought out and worked out upon this interesting, important and urgent question.

DISCUSSION.

Mr. Post: Mr. President and Gentlemen: There was one thing in the paper just read to which I wish to call the attention of this association. One of the suggestions made is that we attempt to protect these fisheries by United States enactments. Now, that is throwing away your powder. In the first place, it has been determined over and over again by the courts of the states and by the Supreme Court of the United States, as was clearly shown in the case of the menhaden fisheries abuse, that was before Congress for some years, that the United States Government has no jurisdiction over those waters. The fisheries along the lines of the states belong to the states themselves, and what protection you get you must get from state authority. It is useless to waste your powder in an effort to do something which cannot be effectual when it is done. The effort was made by the menhaden fishermen in Congress to have such a statute passed, because they thought if they had that matter placed in the hands of the United States Government, that protection would not protect, and they did it to get rid of the enforcement of protection by the State governments. A gentleman from Massachusetts, a lawyer, took great pains to present the matter, and the Massachusetts Commission, at their own expense, before the congressional committee, had long briefs on the subject; so there is no doubt about it at all. Whatever action this body may take with reference to protection, let them take it in the states, and participate in inter-state conventions, where you can endeavor to get uniform enactments from the adjoining States. You will waste your ammunition by trying to get any United States protection. They have no power to do it if they undertook to do it.

There is another thing in this connection which I had in mind to say, while the discussion preceding the reading of this paper was going on. One of the things advocated was that the fishermen should impregnate the eggs of the fish on their boats and scatter them in the water; and that was suggested by Brother Nevin and sanctioned by some of the others. I know that with many men of experience and with many fish culturists it has been a favored notion, and it was one I had at one time, but I had it taken out of me by scientific authority—that is, that a very small proportion of the eggs that were cast by fish naturally were fertilized. In the course of my presentation of the advantages of artificial propagation, I used to make that argument. I used to give the percentage of eggs hatched that we took, and compare them with the probable percentage hatched naturally, and then give the percentage of success in our favor. I made that proposition once in Prof. Reighard's presence—I am sorry he is not here now—and he told me I was probably very largely mistaken in that regard. Of course, he had not experimented with whitefish eggs, but he had with many other eggs, the eggs of reptiles and other fish, and he said the probability was that most of the eggs that are cast by the female were fertilized naturally. The loss does not come from lack of fertilization, but from the destruction of the eggs after they are fertilized. So you see this has an important bearing on the question of the fertilization of fish ova and the benefits and advantages of stripping fish and fertilizing the eggs on the fishing grounds and then throwing them overboard; and it especially has an important bearing upon the value of the fishermen fertilizing the eggs as they catch the fish.

Of course, Mr. President, one statement that Brother Nevin made is rather extravagant. He did not mean it in quite the sense he states it, that not one egg in a million is fertilized by natural methods. As you know, the average of eggs in one whitefish is twenty-five to thirty thousand, and if what he says were so, it would take a great many whitefish to get one egg fertilized. He only meant that figuratively.

Mr. Nevin: I only intended to give a general idea of that.

Mr. Post: My judgment is that the benefit of artificial propagation largely comes from protecting the eggs from their multitude of enemies and carrying them through the period of incubation safely and delivering them as live fish instead of dead eggs into the water. I never believed in the advantage or utility of having the fishermen on the tugs attempt to strip the fish, impregnate the ova and deliver them into the water. I have always looked upon that argument as an excuse to get rid of the hatcheries—as a scheme to antagonize the hatcheries. It has generally, where I have heard it proposed, been proposed, as I thought, with that view. It has a very plausible appearance of advantage to an economical legislature, that instead of the great expense that was laid out in these hatcheries, we might for a very little money get the same results by having the fishermen strip the fish and plant the eggs. I do not believe in it. I do not believe it is of any advantage, and I am pretty well aware, too, of what Mr. Clark said in that connection, that there were very few fish caught from tugs that were ready to be spawned.

At this point Governor Pingree entered the room, and was warmly received by the convention.

Governor Pingree: Don't stop on my account, gentlemen. Keep right on fishing. That is all I can say.

The Governor was invited to address the society, and spoke as follows:

Governor Pingree: I am sorry I could not have met with you yesterday and last evening. I hope you all had a good time. There is room for lots of work in this cause, and I am satisfied that this gentleman here (referring to Mr. Whitaker) could give you all the information that anyone could give from Michigan, else I would have been with you. The fact is, that very few people in Michigan realize how much they lose in not looking after the lakes and in not looking after the fish of Michigan. (Applause.) I am satisfied that you gentlemen are taking an interest in that industry. As I have said, we do not realize how much we lose by not looking after that industry, and nothing pleases me any more than to see you gentlemen interested in this matter.

I did not think of saying anything, but I will say this: When I was first elected Governor, I intimated, and I may say I thought I would make a tour around the lakes and meet every Governor that was about to be elected and see if we could not get them interested in the fish business; but something came up, and I found it was a bigger job than I was able to manage, and so I did not make that trip; but I assure you that it is a grand work, and there is lots of room for work. The people need to be educated in regard to your work. That is what we are in favor of—education.

I thank you for your attention, and, as I say, I am satisfied and know our commissioner here has his heart in this work. I think if he sends up any prayer, he certainly remembers the fish every time. I thank you, gentlemen.

The Chair: Mr. Post, you can resume where you left off.

Mr Post: I can hardly tell where I left off, and I had but a few more words to say. Of course, it seems to me that this general proposition that the provisions of nature for the fertilizing and hatching of whitefish, if they are as faulty as one would be led to believe by the expression that not one out of a million eggs is fertilized, is contrary to all other rules of nature, and we some of us know by actual experience it is not so.

In this connection I would like, while I have the floor, to offer a resolution, which I hope will meet the views of the association. It has a bearing somewhat on the line of our discussion, and I may not have another opportunity to present it.

Resolved, That the American Fisheries Society learns with sincere regret of the deplorable action of the Legislature of Michigan, at its recent session, in so cutting down the appropriations to the Michigan Fish Commission as to seriously cripple the great work it had undertaken and had so well in hand, of restoring and building up the commercial fisheries of the Great Lakes.

Taking into consideration the extensive operations which that commission has carried on for several years, this Society regards such action as a matter of more than mere local interest, and of general public concern, from the tendency to discourage legitimate appropriations to such work in other States, and to dishearten fish culturists everywhere.

We sincerely trust this false economy will be of short duration, and that with the anticipated coming of better times liberal appropriations will again be granted for the purpose of carrying this great undertaking to a successful issue.

Mr. Post: I move its adoption.

The motion was duly seconded and unanimously adopted.

Mr. Clark: There is just one thing I want to bring out in regard to the impregnation of the egg in reply to what Mr. Post says. I made some experiments in this connection, and from those experiments I cannot indorse what Mr. Post brings to us from Prof. Reighard I have done it with whitefish, and that certainly leads me to believe that the impregnation naturally is not very good. I think our friend, Mr. Nevin, has got it too strong altogether, but we do know it is not possible to largely impregnate the eggs in water. We now use the dry method. We know that when you take whitfish eggs in a quantity of water, the percentage of impregnation is lower, according to the quantity of water used with the milt.

Mr. Post: I guess there is no doubt about that, in artificial propagation.

Mr. Clark: If there is no other reason why spawning under natural relations would give us a lower percentage of impregnation, certainly the reason of spawning in open water, where the milt is diluted, would show to us that the impregnation would be quite low, and therefore I cannot see, with the whitefish especially, how the impregnation of the egg would be very high, from that fact. Of course bass make their nests and spawn right in that locality. With whitefish, I do not know but someone is prepared to say just how they spawn, but I am not; but it is probable they spawn something after the manner of the shad, and the shad do not make nests. I have seen shad in the act of spawning, and they spawn and throw the spawn in open water.

Mr. Nevin: Mr. Post does not believe that the impregnation takes place when they throw them overboard off the boat. I can name two grounds—one is at Whitefish Bay, Lake Michigan—used to be fished by Mr. J. P. Clark, of this city. It is practically fished out now. We went on there to plant fish, and the third year there was as high as four thousand pounds taken at a single net. Another point is up at the mouth of the Sturgeon River, and that has failed in within the last twenty years. We have planted overboard there, and it has accomplished great results.

Mr. Whitaker: Let me ask you a question? Where was this?

Mr. Nevin: On Lake Michigan, at Sturgeon Bay.

Mr. Whitaker: Were there any plants of fry made in that vicinity?

Mr. Nevin: Not a fry ever planted there.

Mr. Whitaker: Your commission never planted any on that coast?

Mr. Nevin: No, sir, we never planted any there.

Mr. Bower: I was going to say, that I think on both sides of this question you are going a little to the extreme. I believe where the egg and the milt come in contact, fertilization ensues almost instantaneously, or in a very brief period at least. If the egg and the milt are brought into contact while the spawning process is going on, the eggs must necessarily be fertilized, but when we consider the way in which the fish spawn, naturally, it would seem that a good many eggs are not thus brought into contact with the milt, particularly in a current. The brook trout make a bed and they spawn in the current, where much of the milt is diffused and wasted. But admitting everything that Mr. Nevin says to be true, why not go one step further and save where the great loss occurs? We know these spawning beds are ravaged during the entire season. They are exposed for a period of four to six months, according to the locality, to all kinds of depredations and all kinds of spawn-eating fishes. We would certainly save that, besides the increased percentage of fertilization.

Mr. Davis: I think there is a mistaken idea in regard to the impregnation of eggs in water. We know by actual experience with some fish, at least, there is a large percentage of impregnation in the water, and even in a small current. You take the black bass, in our experiments during the last two or three years, we know by actual experiments that a large proportion of those eggs are impregnated in water. In my opinion, the destruction of the eggs by their natural enemies instead of lack of impregnation. is the reason your results may be so small. Mr. Bower will remember that last spring, in our little pond at Cascade, where we conducted our experiments, we got as high as ten thousand black bass from one pair of fish, estimated. And this is natural impregnation in water. About five thousand bass to each pair, and it strikes me that that in a measure destroys the theory that the eggs will not impregnate in water.

Dr. Parker: I wish to call attention to the fact that we are digressing entirely from this paper.

The Chair: That is true, but these subjects are so intimately related, and the discussion is so interesting, it seems to me very practical, and we will not draw the line as closely as we would otherwise. Mr. Post desired to say something upon that other matter, and he was given permission.

Mr. Nevin: In the fall of 1868 and '69 salmon used to run up the Salmon Creek, on Lake Ontario, by the thousands. We put up a shed there 80 feet long and 30 feet wide, turning the stream practically through the shed. We went to work and built racks about four feet wide and laid them along the width of this floor, and put in wire screens. We thought by allowing the salmon to go on spawning naturally we would get better results. We let the spawning end, and we did not hatch one per cent. It was practically a failure to allow the fish to spawn naturally in that water.

Dr. Parker: Since the discussion has taken this form, I would like to say this: That nature in her wisdom always provides for the continuance of the species, and in those animals—notably the fish—where the destruction of the eggs and young is necessarily very large through their environment, she produces the ova in enormous numbers; for instance, the sturgeon will deposit a million or more and only a few are fertilized, and but fewer still reach the adult form; and so with the codfish, and other forms of sea fish; and the whitefish. The whitefish yields a large percentage of eggs in proportion to the size of the fish. Mr. Davis speaks about the black bass; the eggs are few in comparison with many other fish, but the environment is such that the fertilization is large, and as the black bass protect their eggs, the percentage of young is large. And this law holds good through all forms of animal life, insect life, even plant life; we know that millions of spores of pollen are thrown off; that one seed may be fertilized.

Mr. Post: One seed is the egg.

Dr. Parker: Yes, but it takes millions of good sperms that one egg may be fertilized. When nature furnishes a comparatively small number of eggs, a large number are fertilized, and vice versa; so that the balance is pretty well kept all the way through. What Mr. Davis says about the spawning of bass in still water is correct, and the fact that they did in one instance get ten thousand fish from a single bed in the pond, and the further fact that some beds in the pond averaged a good deal higher—that is, produced a larger number of fish than the beds in the river—show we get a greater percentage of fertilization in still water than in running water.

Mr. Davis: My remarks were made in answer to the remarks by Mr. Clark about eggs not fertilizing in water.

Mr. Clark: No, no, you misquote me. I trust the members will not misunderstand me. I do not claim at all that eggs cannot be impregnated in water. It is not that; but the more water you have, the greater the reduction of the milt power. Don't you see? It is scattered. When you take them in the dry process your eggs are in nothing but the milt, and of course the milt is right around them. If you have a barrel of water and one male fish, the milt is diluted. That is what I wanted to say, not that you cannot impregnate in water.

Mr. Stranahan: I have observed the spawning beds of black bass under very favorable circumstances, where the fish were at home, and I have used marine glasses so their operations could be watched, and at the instant those eggs are dropped there is a flow of milt from the male and they are immediately together.

You can see the eggs drop and you can see the milt spurt out from the male, and I think that accounts for the large percentage of impregnation of black bass. We think they impregnate 95 per cent. of their eggs, while with the whitefish the percentage is very small. The two fish will swim along through the water, casting their eggs and their milt simultaneously.

Dr. Parker: I think Mr. Clark said that he did not know the method of spawning of the whitefish—that he had never seen it. I saw it down here at the Fort fishery once. I was there one fall, and I have every reason to believe it was correct. The fish were spawning in the pond. The male and female came up like this (indicating), rising up nearly to the surface together, with milt streaming down and the eggs from the fish being extruded.

Mr. Clark: Did you see the milt and the eggs?

Dr. Parker: I saw that motion, and the two fish were together, and I have every reason to suppose that it was the act of fertilization.

Mr. Bower: A great many fishermen have theories as to how whitefish spawn. When whitefish spawn, they spawn at night almost entirely, and they can be seen jumping out of the water. Their theory is that they start from the bottom and rush towards the surface, and of course they are making such rapid headway that they fire themselves out of the water. Then, of course, they separate and drop back right close together—the two bodies close together. They go up at an angle through the water until they jump up out of the water.

Dr. Parker: That is what I saw out there.

Mr. Titcomb: I will verify the statements of these two gentlemen. In my operations for the collection of fish, I saw the operations of the fish. They had selected a ledge close to the shore, where the rocks went off abruptly, and I had those lights which I described in my paper, so that I could watch them closely, and the two fish would swim along side by side, rubbing their sides together, with an upward movement through the water. I did not see them jump out of the water, but I could not see the spawn.

Mr. Whitaker: As to impregnation of eggs, I don't believe anyone in the world knows the number of eggs naturally impregnated. It is impossible. A man may make an investigation of certain eggs under certain circumstances, but they may be entirely unlike those that occur in the natural water. What the gentlemen don't want to lose sight of is this question of the fishermen stripping eggs and returning them into the water. On that I take the same position that Mr. Post has. I know it is an argument which has been raised against artificial propagation, for the purpose of discouraging and discrediting our work. That has been one of the subterfuges that has been used. I will not go to the extent of saying I don't believe it ought to be done; but you cannot speak of it in the same breath as you can of the artificial propagation of fish. It is one of the singular things in human experience, and I don't believe there is another instance where artificial means have discounted natural means in their results as in fish culture. What does it mean? It means simply this: that if you take the eggs of the salmonoids, which are easily handled, and impregnate those eggs and get upwards of 90 per cent. as we do, it is not an exception. There is no question but that you have largely increased Nature's ways of doing it in the matter of impregnation. That is not the end of it. That is the beginning of artificial impregnation. The great advantage in natural impregnation is that you isolate the eggs from their enemies until they are born fish. That is where you get a great advantage. The fact of the matter is, when an egg is cast on a natural spawning bed—I don't care whether it is in a stream or the great lakes—that egg is absolutely helpless—it is unprotected. The storms of winter come and stir up the silt from the bottom of these immense seas, and a good proportion of these eggs are covered with mud. In addition to that, if there is a choice viand for any fish, it is the eggs of its own or the eggs of some other variety of fish. You isolate the ova in artificial propagation from their enemies, and that is where the great percentage of gain is made by artificial means.

I would not discourage the idea of impregnating them and putting them back, although I don't think there is a great deal gained by it. Instead of having those eggs thrown away, if you only get five per cent. of impregnation, you have gained that much; they have not gone absolutely to waste.

In this matter of natural impregnation of eggs, I hold with Mr. Clark, and with some of the other gentlemen, and it seems to me that the discovery of Vrasski and Seth Green—a re-discovery, perhaps, by an independent observer of the process of dry fertilization of eggs shows a great improvement over natural methods. Mr. Green once told me that in the beginning, when he began to strip fish, he only got an impregnation of about 25 or 30 per cent. He then said to himself, if something better than that could not be done we might as well quit the business. I inquired of him how he came to settle upon this question of dry impregnation. He said he reduced the amount of water gradually, and when he got it down so as to have enough to just free his eggs from the pan, he brought his impregnation up to nearly 100 per cent. There is no question in my mind—I know it from reasoning by deduction—I know it in no other way—that the very idea in nature of making fish so prolific was the idea that a large percentage of ova was lost, but if it were not for the interference of man, the stock would be maintained even in the way nature provides.

Mr. Bryant: I desire to offer the following resolution:

Resolved, That the warmest thanks of this Society be extended to the Hon. James McMillan and Mr. M. S. Smith, of Detroit, to the Lake St. Clair Shooting and Fishing Club, and to the anglers of the City of Detroit, to the officials of the Michigan Central Railroad, and the press of Detroit. Their courtesies, hospitable entertainment and kindly attentions have added to the pleasure of our meeting, and made our visit one to be cherished among pleasant memories.

I move the adpotion of the resolution.

The motion was unanimously adopted.

On motion, the Society then took a recess until the following day, the meeting to be held at the Paris, Mich., hatchery.

On the evening of the 18th the Society took a special train of private cars, as the guests of the Michigan Central Railway Co., and were taken to the Paris hatching station of the Michigan Fish Commission, some two hundred miles from Detroit, returning to Detroit the evening of the day following.

The Society then adjourned until to-morrow.

PROCEEDINGS OF SATURDAY, JUNE 19, 1897, AT THE SESSION HELD AT PARIS, MICH.

President: The first business in order is the reading of a paper by Mr. James Nevin, of Wisconsin, on Pike Eggs.

Prof. Birge: I wish to say that this is a portion of the report of Mr. Nevin, which was submitted to the Wisconsin Board, and relates to the loss of pike-perch eggs after they had arrived at the eyed condition, and we thought it might possibly be of interest to the Society.

The paper was then read by Prof. Birge, as follows:

WALL-EYED PIKE.*

By JAMES NEVIN, of Wisconsin.

Some 190,000,000 wall-eyed pike eggs were collected this year during the spawning season. The pike eggs are the most delicate eggs with which we have to deal. It is seldom that the fish culturist succeeds in impregnating more than 50 per cent. of the eggs he takes.

We were very successful this year in securing male fish with which to impregnate the eggs, and with our improved methods of caring for the eggs during the time of taking them, we ought to have had 100,000,000 fry to distribute. The eggs cleaned up in the very best form. After they had been in the jars some thirty days, and the embryo was well advanced, they began to die in the hatching jars, and have died off in such large numbers that we will not have over 30,000,000 fry to distribute.

In my report to the Commission last winter, I recommended that a cheap hatchery be built at Oshkosh, where the water in which this fish hatches naturally can be had for hatching purposes. I am satisfied now, that if we had built such a hatchery this spring, we would have had over 100,000,000 wall-eyed pike fry to distribute.

Last year was the first instance in which we have had any pike eggs die in the jars at the Milwaukee hatchery, after the eye of the fish was discernible. In previous years the loss of eggs occurred in all cases before the eggs had reached that stage in which you can distinguish the eye of the fish in the egg. Such losses, I have always held, were due to the scarcity of male fish, or that the milt from the males—which were always undersized—was not of sufficient strength to produce strong and healthy impregnation. This year we had an abundance of excellent male fish, and many more than we required; and the results, so far as fertilizing the eggs was concerned, was very satisfactory, as experiments made at the time the eggs were taken fully demonstrated. In these experiments we held the eggs of the pike in the river water, from which the parent fish were taken; for fifteen days, and we had no loss with the eggs.

* Extract from Report of Superintendent James Nevin to the Fish Commissioners of Wisconsin, dated June 15, 1897.

The cause of the loss of pike in the egg stage at Milwaukee I attribute to the low temperature of the water. Some two years since the Milwaukee water works began to take their supply of water from the new intake, and the temperature of water which we now get for hatching is much lower than in past years, so low that the fish will not mature as quickly as they should, but die in the egg. At no time this spring has the temperature of the water gone above 48 degrees Fahrenheit, which is the usual temperature of spring water in our State.

Twelve years ago I attempted to hatch pike eggs at the Madison hatchery in water drawn from one of our ponds at a temperature of 50 F., but the fish began to die in the eggs as they did at the Milwaukee hatchery this spring. At that time I fixed up a temporary place below the mill dam on Lake Mendota, transferred the eggs to this improvised hatchery, and thus saved the year's hatch.

At the next meeting of the Board I hope to be able to advise the Commissioners as to what can be done in the way of securing water and a site for a hatchery at Oshkosh for hatching our pike eggs in the future.

Following the reading of the paper a discussion was held upon the paper, which was participated in by Mr. Clark, Mr. Titcomb, Prof. Reighard, Mr. Bower, Prof. Birge and Mr. Nevin, and others. There being no stenographer present, the discussion does not appear.

Mr. Titcomb moved to reconsider the motion by which the Society yesterday directed that five copies of the proceedings should be given to each member.

The motion was supported, and being put, was carried.

President: The motion has been reconsidered and is now before you for action. What is your pleasure?

Mr. Titcomb: I move the Secretary be directed to have printed five hundred copies of the report.

President: It is understood, of course, that these reports are not for general distribution, but if members desire additional copies they can undoubtedly be had.

Mr. Titcomb's motion was supported, and being put, was carried.

On motion, the Society then adjourned.

FEEDING TROUT FRY, OR THE FOOD PROBLEM SOLVED.*

By S. E. LAND, Wyoming Fish Culturist,

To begin the process of providing food for fishes, we should first look into nature's mirror; what kind of food is most natural to the fish which we have in hand. Next, what are the temperatures of water most suitable to the habitat of such fish. Let us take for example the young trout, salmo fontinalis; while this fish is developing from sac stage to feeding stage, say in water at 45 degrees Fah., when the sac on these fish is one-third absorbed, just before they begin to scatter, they will take very fine food if fed little and often during the day. In nature we find these small fish feed in that way and they do survive if planted in water where insect life is known to abound, and temperature of water is below 60 degrees. In order to come as near as possible with artificial food, to that which is provided by nature, we take the animal food and prepare it as fine as flour, then mix it with water and feed it in a diluted form to the fry impounded in the hatchery troughs. When fry are removed to the nursery ponds, this fine food should be furnished from first to last or until fry are fingerlings. The food problem is then solved and the result is no loss from starvation.

The most natural food is fish flesh, suckers or any inferior fish can be fed to trout. To prepare such food for fry, to save labor and get the best results, fish should be taken without dressing and be cut up so they will go through a meat cutter, then of this ground fish flesh two-thirds should be placed in a tin milk pan with one-third water and baked in an oven until the water is evaporated and the fish flesh is done thoroughly; then put this cooked fish flesh through the meat chopper again, this makes a paste, and if not fine enough, you can grate it through a fine sieve, but it must be as fine as flour when you mix it with water to feed to your small fry. You can do this with liver and get good results, but the fish flesh with this pulverized and cooked fish bone in it, is more natural and more beneficial to the young trout.

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* The following paper was received too late to be read before the Society, but is published as a valuable contribution to the subject of which it treats.

During the whole time you feed, be sure that the whole surface of the water is covered with this mixture of fine food, then you will know that all fry in your troughs have had some food at each feeding. To feed fish at head of troughs and expect those at lower end will come up to feed, is folly. Once a trout is off its feed it will not come for the food thrown in a pond or at head of trough, but there little weaklings will literally starve to death, as thousands of them do at most every hatchery institution.

The next thing to be done is to thin out from troughs to nursery ponds and to feed properly there. You should have water falling into your ponds in at least a dozen places, say through small open tin spouts on each side and upper end of your ponds. You will find thousands of fry at all times under these spouts, that should have a 6-inch fall to aereate water; there the fry stay and watch for food. When you pour in the liquid food at intake of your ponds, it flows out through these spouts and all fish in nursery ponds get fed, otherwise starvation and death are the results.

When it is possible keep young trout in spring water, that never is at a higher temperature than 50 degrees Fahr., but any water from 40 degrees to 50 degrees is excellent. After trout are six months old or yearling and adult trout, water from 50 degrees to 60 degrees will cause no mortality; but plenty of food and plenty of running water is absolutely necessary to get the best results.

I do not believe in forcing the growth of the trout, like one man I found at Caroline, R. I., who refused to show me his ponds or trout for fear I would infringe on his right of rapid trout production. He said: Sir, I can grow trout so fast that I can get the eggs from my fish and get them on the market as long yearlings and make them weigh three to the pound; that beats selling your two-year-old trout that the other fellow raises and has to put in four to the pound." But when I asked that man if he sold all his trout as long yearlings, if there was not danger of him selling himself out of business. He replied that he forced the eggs to grow in the fish by the time they were one year old. This beats the growth of trout on natural food, which abounds in the waters of the Big Horn Mountains, and creates a growth of trout of one pound to the year after they are two years old.

For the past four years I have had better results in feeding cooked food to trout when prepared very fine, than I ever did in feeding raw liver that bleaches out and swells when put in water; also fouls the water in troughs when fish do not eat it. Whereas cooked food is always eaten by the fish when finely prepared and fed in diluted form, and fish are fed from four to six times a day.

There is only one way to solve the food problem, and that is to give your fry and adult fish plenty of food and plenty of water. Avoid overcrowding in rearing, and overcrowding in shipping, and last but not least of all it is essential to handle all trout and young fish in cold water, and if fry are shipped in water below 40 degrees in refrigerator fish cans, there is absolutely no loss in transportation at any season of the year.

CONSTITUTION.

ARTICLE I.

NAME AND OBJECTS.

The name of this society shall be American Fisheries Society. Its objects shall be to promote the cause of fish-culture; to gather and diffuse information bearing upon its practical success, and upon all matters relating to the fisheries; the uniting and encouraging of the interests of fish-culture and the fisheries, and the treatment of all questions regarding fish, of a scientific and economic character.

ARTICLE II.

MEMBERS.

Any person shall, upon a two-thirds vote and the payment of three dollars, become a member of this society. In case members do not pay their fees, which shall be three dollars per year, after the first year and are delinquent for two years, they shall be notified by the treasurer, and if the amount due is not paid within a month thereafter, they shall be, without further notice, dropped from the roll of membership. Any person can be made an honorary or a corresponding member upon a two-thirds vote of the members present at any regular meeting.

ARTICLE III.

OFFICERS.

The officers of this Society shall be a President and a Vice-President, who shall be ineligible for election to the same office until a year after the expiration of their term; a Corresponding Secretary, a Recording Secretary, a Treasurer and an Executive Committee of seven, which with the officers before named shall form a council and transact such business as may be necessary when the Society is not in session, four to constitute a quorum.

ARTICLE IV.

MEETINGS.

The regular meeting of the Society shall be held once a year, the time and place being decided upon at the previous meeting, or, in default of such action, by the Executive Committee.

ARTICLE V.

CHANGING THE CONSTITUTION.

The Constitution of the Society may be amended, altered or repealed by a two-thirds vote of the members present at any regular meeting, provided at least fifteen members are present at said meeting.

LIST OF MEMBERS.

ACTIVE.

Adams, E. W., 114 Wall st., N. Y.
Amsden, F. J., Rochester, N. Y.
Alexander, L. D., 50 Broadway, New York.
Anderson, J. F., 240 Eleventh st., Jersey City, N. J.
Annin, James, Jr., Caledonia, N. Y.
Ashe John E., Fonda, N. Y.
Atkins, Chas. G., East Orland, Me.
Ayer, F. W., Bangor, Me.
Babcock, C. H., Rochester, N. Y.
Bartlett, Dr. S. P., Quincy, Ill.
Bean, Dr. T. H., Battery Park Aquarium, N. Y.
Bell, Currie G., Bayfield, Wis.
Belmont, Hon. Perry, 19 Nassau st., N. Y.
Benkard, James, Union Club, N. Y.
Bickmore, Prof. A. S., American Mus. Nat. Hist., N. Y.
Birge, Prof. E. A., Madison, Wis.
Bissell, J. H., Detroit, Mich.
Blackford, E. G., Fulton Market, N. Y.
Booth, A., corner Lake and State sts., Chicago, Ill.
Bottemanne, C. J., Bergen op Zoom, Holland.
Bower, Seymour, Detroit, Mich.
Bowman, W. H., Rochester, N. Y.
Bradley, Dr. E., 19 West 30th st., N. Y.
Brice, Col. J. J., Washington, D. C.
Brush, Dr. E. F., Mount Vernon, N. Y.
Bryant, E. E., Madison, Wis.
Bulkley, H. Seymour, Odessa, Mass.
Buller, N. R., Mauch Chunk, Pa.
Cary, Dr. H. H., Lagrange, Ga.
Chamberlayne, C. F., Buzzard's Bay, Mass.
Cheney, A. N., Glens Falls, N. Y.
Clark, F. N., Northville, Mich.
Corwin, D. P., 413 Wood st., Pittsburg, Pa.
Crook, Abel, 99 Nassau st., N. Y.
Crosby, H. F., P. O. Box 3714, New York.

Dale, J. A., York, Pa.
Davis, B. H., Palmyra, N. Y.
Davis, Hon. Geo. B., Utica, N. Y.
Davis, H. W., Grand Rapids, Mich.
Demuth, H. C., 114 East King st., Lancaster, Pa.
Dickerson, F. B., Detroit, Mich.
Douredore, B. L., 103 Walnut st., Philadelphia, Pa.
Doyle, E. P., Port Richmond, N. Y.
Ebel, Hon. F. W., Harrisburg, Pa.
Ellis, J. F., U. S. Fish Commission Washington, D. C.
Emerick, H. F., San Francisco, Cal.
Fox, J. C., Put-in-Bay, O.
Foggin, Frank, Port Richmond, N. Y.
Friesmuth, C. N., Jr., 151 North Third st., Philadelphia, Pa.
Frothingham, H. P., Mt. Arlington, N. J.
Gavitt, W. S., Lyons, N. Y.
Griffith, C. E., Port Richmond, N. Y.
Gunckel, J. E., Toledo, O.
Hackney, D. G., Ft. Plain, N. Y.
Hagert, Edwin, 32 North Sixth st., Philadelphia, Pa.
Haley, Caleb, Fulton Market, N. Y.
Hamilton, Robert, Greenwich, N. Y.
Hansen, G., Osceola, Wis.
Hartley, R. M., 627 Walnut st., Philadelphia, Pa.
Harris, J. N., Fulton Market, N. Y.
Henshall, Dr. J. A., U. S. Fish Com., Washington, D. C.
Hessell, Rudolph, U. S. Fish Com., Washington, D. C.
Hill, J. L., 115 Broadway, New York.
Hinchman, C. C., Detroit, Mich.
Holden, H. S., Syracuse, N. Y.
Hoxie, J. W., Carolina, R. I.
Hughes, T. W. B., 258 Broadway, New York.
Hoyt, Dr. A. W., 243 Wabash ave., Chicago, Ill.
Hurlbut, H. F., 5 Lincoln st., Lynn, Mass.
Hunsaker, W. J., Detroit, Mich.
Huntington, L. D., New Rochelle, N. Y.
Huntington, W. R., Cleveland, O.
Hutchinson, E. S., Washington, D. C.
Hyneman, A. A., 55 West 33rd st., New York.
James, Dr. B. W., N. E. Cor. 18th and Greene sts., Philadelphia, Pa.
Jennings, G. E., Fishing Gazette, New York.
Johnson, S. M., Union Wharf, Boston, Mass.
Jones, Alex. Woods, Holl, Mass.
Jones, Dr. O. L., 116 West 72d st., New York.
Kauffman, S. H., Evening Star, Washington, D. C.
Keene, J. H., Baltimore, Md.
Kelly, P., 346 Sixth ave., N. Y.

Kilburn, F. D., Banking Department, Albany, N. Y.
Lyman, H. H., Oswego, N. Y.
McGown, Hon. H. P., 108 Fulton st., New York.
Mackay, R. M., 1517 N. 14th st., Philadelphia, Pa.
Mallory,Chas., Burling Slip, N. Y.
Manning, W. W., Marquette, Mich.
Mansfield, Lt. Com. H. B., U. S. Navy., St. Louis, Mo.
Manton, Dr. W. P., Detroit, Mich.
May, W. L., Omaha, Neb.
Meehan, W. E., Public Ledger, Philadelphia, Pa.
Merrill, F. H. J., State Museum, Albany, N. Y.
Milbank, S. W., Union Club, N. Y.
Miller, Ernest, Fulton Market, N. Y.
Miller, S. B., Fulton Market, N. Y.
Mills, G. T., Carson City, Nev.
Morrell, Daniel, Hartford, Ct.
Mosher, Stafford, Ft. Plain, N. Y.
Murdock, W. C., San Francisco, Cal.
Nash, Dr. S. M., 23 West 33rd st., New York.
Nevin, James, Madison, Wis.
O'Brien, W. J., South Bend, Neb.
O'Hage, Dr. Justus, St. Paul, Minn.
Osborn, Wm., Duluth, Minn.
Offensend, J. H., Fairhaven, Vt.
Page, W. F., U. S. Fish Com., Neosho, Mo.
Page, P. W., West Summit, N. J.
Palmer, G. H.
Parker, Dr. J. C., Grand Rapids, Mich.
Peabody, George F., Appleton, Wis.
Pfeffer, George, Jr., Camden, N. J.
Post, Hoyt, Detroit, Mich.
Powell, W. L., Harrisburg, Pa.
Powers, J. A., Lansingburg, N. Y.
Preston, Hon. J. L., Columbiaville, Mich.
Preston, Dr. H. G., 98 Lafayette Sq., Brooklyn, N. Y.
Rathbone, Wm. F., D. & H. R. R., Albany, N. Y.
Ricardo, Geo., Hackensack, N. J.
Rathbun, Richard, Smithsonian Institution, Washington, D. C.
Ravenel, W. de C., U. S. Fish Com., Washington, D. C.
Russel, Henry, Detroit, Mich.
Rowinville, E. T., East Freetown, Mass.
Schaffer, Geo. H., 15 Centre st., New York.
Sherwin, H. A., 100 Canal st., Cleveland, O.
Smiley, C. W., 943 Massachusetts ave., Washington, D. C.
Spensley, C., Mineral Point, Wis.
Steers, Ed. P., 2076 Fifth ave., New York.
Stelwagen, W., 525 Commerce st., Philadelphia, Pa.

Stone, Livingston, Baird, Cal.
Stranahan, J. J., Put-in-Bay, O.
Streuber, L. Erie, Pa.
Sykes, Henry, Bayfield, Wis.
Sweeney, Dr. R. O., Duluth, Minn.
Taylor, Alex., Jr., Mamaroneck, N. Y.
Thompson, Edward, Northport, L. I., N. Y.
Titcomb, J. W., St. Johnsbury, Vt.
Tomlin, W. D., Duluth, Minn.
Upton, W. G., Warren, O.
Van Cleef, J. S., Poughkeepsie, N. Y.
Walker, Bryant, Detroit, Mich.
Walters, C. H., Cold Spring Harbor, N. Y.
Walton, C. W., 1713 Spring Garden st., Philadelphia, Pa.
Webb, W. Seward, 44th st. and Vanderbilt ave., New York.
Weed, W. R., Potsdam, N. Y.
Whitaker, Herschel, Detroit, Mich.
Whitaker, E. G., 29 Broadway, New York.
White, R. Tyson, 320 Bridge st., Brooklyn, N. Y.
Wilbur, H. O., 235 3rd st., Philadelphia, Pa.
Willetts, J. C., 49 Wall st., New York.
Wilmot, Samuel, Newcastle, Ont.
Witherbee, W. C., Port Henry, N. Y.
Wood, C. C., Plymouth, Mass.
Zweighalt, S., 104 West 71st st., New York.

HONORARY.

The President of the United States.
The Governors of the several States.
Borodine, Nicholas, Delegate of the Russian Association of Pisiculture and Fisheries, Uralsk, Russia.
Jones, John D., 51 Wall st., N. Y. City.
Mather, Fred, 63 Linden st., Brooklyn, N. Y.
Southside Sportsmen's Club, Oakdale, L. I., N. Y.
New York Association for the Protection of Fish and Game, New York City.
Lake St. Clair Shooting & Fishing Club, Detroit, Mich.
Woodmont Rod and Gun Club, Washington, D. C.
Fish Protective Association of Eastern Pennsylvania, 1020 Arch st., Philadelphia, Pa.

CORRESPONDING.

Apostolides, Prof. Nicoly Chr., Athens, Greece.
Armistead, J. J., Dumfries, Scotland.
Benecke, Prof. B., Commissioner of Fisheries, Konigsberg, Germany.
Birbeck, Edward, Esq., M. P., London, England.

Brady, Thos., F., Esq., Inspector of Fisheries, Dublin Castle, Dublin, Ireland.

Feddersen, Arthur, Viborg, Denmark.

Giglioli, Prof. H. H., Florence, Italy.

Ito, K., Member of Fisheries' Department of Hokkaido and President of the Fisheries' Society of Northern Japan, Sapporo, Japan.

Jaffe, S., Osnabruck, Germany.

Juel, Capt. N., R. N., President of the Society for the Development of Norwegian Fisheries, Bergen, Norway.

Landmark, A., Inspector of Norwegian Fresh Water Fisheries, Bergen, Norway.

Lundberg, Dr. Rudolph, Inspector of Fisheries, Stockholm, Sweden.

Macleay, William, President of the Fisheries' Commission of New South Wales, Sydney, N. S. W.

Maitland, Sir James Ramsay Gibson, Bart., Howieton, Stirling, Scotland.

Malmgren, Prof. A. J., Helsingfors, Finland.

Marston, R. B., Esq., Editor of the Fishing Gazette, London, England.

Olsen, O. T., Grimsby, England.

Sars, Prof. G. O., Government Inspector of Fisheries, Christiania, Norway.

Senior, William, London, England.

Smitt, Prof. F. A., Stockholm, Sweden.

Sola, Don Francisco Garcia, Secretary of the Spanish Fisheries' Society, Madrid, Spain.

Solsky, Baron N. de, Director of the Imperial Agricultural Museum, St. Petersburg, Russia.

Trybom, Dr. Filip, Stockholm, Sweden.

Walpole, Hon. Spencer, Governor of the Isle of Man.

Wattel, M. Raveret, Secretary of the Societe d'Acclimatation, Paris, France.

Young, Archibald, Esq., Inspector of Salmon Fisheries, Edinburgh, Scotland.

MINUTES

OF THE

AMERICAN FISHERIES SOCIETY

AT ITS

TWENTY-SEVENTH ANNUAL MEETING

HELD AT THE HOTEL MILLARD, OMAHA, NEBRASKA,
ON THE 20TH, 21ST AND 22ND DAYS
OF JULY, 1898.

SPEAKER PRINTING COMPANY,
DETROIT.

OFFICERS FOR 1898-99.

President—GEORGE F. PEABODY, Appleton, Wis.
Vice-President—WILLIAM H. BOWMAN, Rochester, New York.
Recording Secretary—HERSCHEL WHITAKER, Detroit, Mich.
Corresponding Secretary—J. E. GUNCKEL, Toledo, O.
Treasurer—L. D. HUNTINGTON, New Rochelle, New York.

EXECUTIVE COMMITTEE.

J. A. DALE, York, Pa.
E. E. BRYANT, Madison, Wis.
J. J. STRANAHAN, Put-in-Bay, O.
F. N. CLARK, Northville, Mich.
J. W. TITCOMB, St. Johnsbury, Vt.
W. L. MAY, Omaha, Neb.
DR. J. A. HENSHALL, Bozeman, Mont.

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PROCEEDINGS OF TWENTY-SEVENTH ANNUAL MEETING OF AMERICAN FISHERIES SOCIETY AT THE HOTEL MILLARD, OMAHA, NEB., JULY 20, 21 AND 22, 1898.

FIRST DAY'S PROCEEDINGS.

MORNING SESSION.

At 10 o'clock a. m., July 20th, the Society was called to order by the President, Hon. W. L. May.

The following members were present:

Geo. F. Peabody, Wisconsin; Seymour Bower, Michigan; J. J. Stranahan, Ohio; J. E. Gunckel, Ohio; F. N. Clark, Michigan; James Nevin, Wisconsin; E. A. Birge, Wisconsin; Calvin Spencley, Wisconsin; W. L. May, Nebraska; W. J. O'Brien, Nebraska; Herschel Whitaker, Michigan; J. A. Dale, Pennsylvania.

The president announced that owing to a lack of time he had not prepared any formal welcoming address, and that he took pleasure in introducing Mr. James H. Adams, who would welcome the society on behalf of the City of Omaha.

Mr. James H. Adams, the secretary of the Mayor of Omaha, in well-chosen words extended a hearty welcome to the members, offering them every opportunity that could be afforded by the city officials and the Mayor's office to see the city and its industries and attractions.

Mr. Spencley responded on behalf of the Society in fitting words, expressing thanks for the courtesies extended, with a promise that the members would avail themselves of the opportunities offered.

The Treasurer being absent, Mr. Peabody was elected Treasurer pro tem.

The President announced that the next business in order was the presentation of candidates for membership, and the following were proposed:

John D. McLeod, Milwaukee, Wis.; S. L. Griffith, Danby, Vt.; A. C. Rosenburg, Kalamazoo, Mich.; George M. Brown, Saginaw, Mich.; Professor H. C. Bumpus, Providence, R. I.; George L. Alexander, Grayling, Mich.; Professor J. E. Reighard, Ann Arbor, Mich.; E. A. Tulian, Leadville, Col.; John G. Ruge, Apalachicola, Fla.; G. C. Leach, St. Louis; Mo.; H. A. Morgan, Baton Rouge, La.; Professor Henry B. Ward, Lincoln, Neb.; R. S. Oberfelder, Sidney, Neb.; W. W. Barrett, Church's Ferry, N. D.

The President appointed Mr. C. Spencley to act with Mr Dale and Mr. Clark, members of the executive committee, and the names of the candidates were referred to the committee for action.

After consultation the executive committee, through its chairman, Mr. Dale, reported favorably upon the admission of the candidates for admission.

The report of the committee was accepted and adopted, and the applicants declared duly elected.

The President: The next business in order is the reports of officers. I wish to say that I had not supposed it was customary for the President to present any formal report, and therefore have no report to present. We will listen to the report of the Secretary.

The Secretary reported as follows:

To the American Fisheries Society:

Gentlemen: I beg leave to submit the following report for the past year:

Immediately after the close of the last meeting I had two copies of the stenographer's minutes prepared, one of which I retained, the other was separated, the different portions being sent to the members participating in the discussion, for correction, with a printed slip attached urging immediate revision and return. Prompt responses were received, and this action on the part of members greatly facilitated the work of the Secretary, enabling me to put the proceedings into the hands of members at the earliest date by far since I have had an acquaintance with the Society.

Bids were solicited from four responsible firms for the printing of the report, and the lowest bid was accepted, being much below any others received. Not only was the price per thousand ems lower, but the quantity of matter set to the page was greater, the type being considerably smaller than that used in prior reports.

During the year I have sent out to members personal letters requesting their co-operation in securing candidates for membership. While this did not meet with the general hearty response looked for, something was done, and I wish specially to acknowledge the assistance of the Hon. J. W. Titcomb for the interest taken by him in this effort. He has secured four applications, and I think has others in view. This work was done without any special effort on his part by simply keeping the matter in mind. I have secured seven applications, and would suggest to members the advisability of doing a little of this work in the future, which will result in bringing in persons who, even if they do not attend, are interested in our work and would be quite willing to take membership for the purpose of getting the reports of the Society.

The inducement held out to persons to join used by Mr. Titcomb and myself was that a person putting in his application during the interim between meetings would receive the report of the last meeting gratis, and his application not coming in to be acted upon until the next meeting he was thus practically given the benefit of a two years' membership for one year's fee. I know no better use to be made of the reports on hand, after the distribution has been made to members.

Following out the suggestion of the society at the last meeting, in May of this year I prepared and sent out a circular to the membership, and to others likely to be interested in our work, inviting their attention to the Omaha meeting, and asking them to contribute papers on some subject of interest to the Society. The result was very encouraging, as is evidenced by the excellent program of papers prepared for this meeting, which is in your hands. I think the preparation of a program in advance is a good idea and has fulfilled the expectations of those who suggested it, and in my opinion should be followed out every year.

Following the issuing of the program, 175 postal cards with return reply attached were sent out to members asking them to notify me whether they would attend the meeting, so some arrangement could be made for their comfort in the way of transportation, not otherwise to be secured.

The work of this office in the way of correspondence has been quite voluminous, something like three hundred personal letters having been received and answered. This, in connection with the preparation of the report and the issuing of circulars and program, has called for the expenditure of considerable time, but if it shall result in added interest in our work and a successful meeting it has been worth what it cost in expenditure of time.

On the recommendation of my predecessor in office, the Society directed an official seal be procured, which I did. I can see no use to which the seal may be put, but I have carried out the direction of the Society in this regard.

In making up the report last year I found that the nominating committee, in its report, which was unanimously adopted, had made a mistake in putting on the executive committee a gentleman who was not a member of the Society. This fact was overlooked at the time of the adoption of the report. While the gentleman named would have been a most desirable member of that committee, considering the fact above stated, I took the liberty of substituting in his stead the name of Mr. H. A. Sherwin, who was present at the meeting, and who takes an active interest in our success.

After issuing the report of the last meeting my attention was called to the omission from the list of active members of the name of Mr. Carl Thompson. This was a mistake, the gentleman having paid his dues and being in good standing as a member. His name was included in the report sent by me to the Treasurer as among those who had paid dues. How the error occurred is unexplainable, but it is one of those annoying mistakes which will occur. His name should be placed in the next list published. A letter was written Mr. Thompson apologizing for the mistake.

Following out the action taken at the last meeting, copies of proceedings were only sent to those entitled to them on account of membership. Complaint as to this has arisen only in one instance to my knowledge. Mr. C. B. Reynolds, the proprietor of Forest and Stream withdrew from membership in the Society at the last meeting. Soon after the distribution of the report Forest and Stream contained an article commenting on the action of the Society in confining the distribution of its reports to members. The article seemed to me to require a reply, and the following was sent to that paper and was printed:

Detroit, Mich., Oct. 11, 1897.

Editor Forest and Stream:

My attention has been called to an item on the first page of your issue of October 9th stating that you had failed to receive a report of the American Fisheries Society, and commenting on the action of the Society in restricting the distribution of its reports to its members. While the Society did so restrict the distribution, I knew it was not its intention to exclude the sporting press, and, therefore, immediately on its issue I mailed to Forest and Stream and other kindred publications a copy. If your copy was not received it must have been through some fault of the mails. I know the copies mailed to some of the other papers were received and I presumed you had received yours. There was no intention of denying Forest and Stream a copy. I wish you would give this letter publication in order that neither the Society nor myself may be misunderstood in this matter.

HERSCHEL WHITAKER.

Mr. Fred. Mather also wrote an article on this subject to that paper, which was published before the one written by me, given above. Mr. Mather took the ground, which is the true one, and which appealed to him after a long connection with this Society as its Secretary, that the possession of the reports should be one of the strongest inducements for persons interested in our work to join is they wished to enjoy its benefits and privileges.

The report of the Secretary was accepted and ordered printed.

The report of the Treasurer was then submitted, as follows:

New Rochelle, N. Y., July 12, 1898.

To the American Fisheries Society:

Gentlemen: I herewith submit my report as Treasurer from June 15, 1897, to July 10, 1898:

By my report rendered June 15, 1897, the balance in hands of Treasurer was		$327 77
Dues since collected amount to $348, as follows:		
1894 dues	$6 00	
1895 dues	6 00	
1896 dues	6 00	
1897 dues	330 00	
		348 00
		$675 77
Disbursements		274 51

Leaving a balance in hands of Treasurer at this date of $401 26.

The membership is about the same as at last report, eleven new members being elected at the last meeting in June, 1897. Lost by death, 1, Mr. David G. Hackney, of Ft. Plain, N. Y. By resignation, 4, Dr. T. H. Bean, Frank Foggin, R. M. Mackay and H. H. Lyman. By request to have their names dropped from list of membership, 3, Edward Thompson, J. E. Ashe, C. E. Griffith. One who claims he is not a member, A. A. Hyman. Not to be found, S. H. Palmer. Dropped for non-payment of initiation fee, Dr. A. W. Hoyt. For non-payment of dues under constitutional provision, 4. C. F. Chaberlayne, elected in 1894 and paid '94 dues only. G. W. Upton, elected in 1893 and paid 1893 dues only. W. R. Huntington, elected in 1893, paid 1893 dues only. J. F. Offensend, elected in 1892, paid only 1892 and 1893 dues, and one who requests his name to be dropped for non-payment of dues, Mr. C. W. Smiley, elected in 1894 and paid only 1894 and 1895 dues. Total dropped and resigned, 16.

There remains a trifle larger amount of dues uncollected than at the close of last year, although bills with special requests were sent to all members in arrears on August 20th, October 20th and December 20th, 1897, and on March 20th and June 10th, 1898. The request sent December 20th contained a return stamped envelope.

I submit this as supplementary to my regular report, as general information for those present at the twenty-seventh annual meeting. Yours truly,

L. D. HUNTINGTON, Treasurer.

American Fisheries Society in account with L. D. Huntington, Treasurer:

RECEIPTS.

June, 1897, balance in hands of Treasurer......	$327 77	
Received at hands of H. Whitaker, Secretary, dues collected at meeting held at Detroit, June, 1897, 1894 dues $6, 1895 dues, $6, 1896 dues $3, 1897 dues $69........................	84 00	
Dues received by Treasurer direct from members, 1894 dues 0, 1895 dues 0, 1896 dues $3, 1897 dues $261	264 00	
		$675 77

DISBURSEMENTS.

June, 1897, account of Treasurer direct, typewriting 65c, express 25c........................	90
August 20, 1897, account of Treasurer direct, postage stamps........................	4 12
September, 1897, account of Treasurer direct, printing and stationery........................	3 25

October, 20, 1897, account of Treasurer direct, postage stamps	2 34	
December 20, 1897, account of Treasurer direct, typewriting 75 letters	2 50	
December 20, 1897, account of Treasurer direct, postage stamps	3 40	
January, 1898, account of Treasurer direct, printing and stationery	1 50	
January, 1898, account of Treasurer direct, postage on reports	56	
March, 1898, account of Treasurer direct, printing stationery	1 50	
March, 1898, account of Treasurer direct, postage stamps	1 40	
June 10, account of Treasurer direct, postage stamps	86	
July 10, account of Treasurer direct, postage stamps	30	
August 23, 1897, account of Treasurer direct, Speaker Printing Co., printing proceedings	113 95	
October, 1897, account of Treasurer direct, L. B. Case, stenographer at Detroit meeting	81 80	
April, 1898, account A. N. Cheney, 1896, Secretary, $3.70, $5.20	8 90	
Account H. Whitaker, Secretary, as per his account, postage	18 95	
Account H. Whitaker, Secretary, as per his account, expressage	8 68	
Account H. Whitaker, Secretary, as per his account, printing and stationery	15 10	
Account H. Whitaker, Secretary, as per his account, official seal	4 50	
		274 51

Balance in hands of Treasurer, July 10, 1898........$401 26

L. D. HUNTINGTON, Treasurer.

New Rochelle, July 12, 1898.

A recess was then taken to afternoon.

AFTERNOON SESSION.

Mr. Peabody in the chair.

Secretary Whitaker: There are two items of business here that I think had better be attended to before we proceed with the regular program.

I have invitations from different parties in regard to the meeting of the Society for next year.

Secretary Whitaker then read a letter from David S. Rose, Mayor of Milwaukee, and also a telegram sent by the Citizens' Business League of Milwaukee to the President of this Society; also a letter from John W. Titcomb, President of the Vermont Fish Commission; also a letter from A. S. Hastings, Mayor of Niagara Falls, N. Y.; also a letter from the President of the State Park of Niagara Falls, inviting the Society to meet at that place.

I think it would be well to appoint a committee to select the place of meeting for next year, and I move that the chair appoint a committee of three to decide upon the next place of meeting.

The motion was duly seconded and unanimously carried.

The Chair: I will name that committee later on.

Secretary Whitaker: I move that the invitations read be received placed on file and referred to the committee.

The motion was duly seconded and carried.

President W. L. May then resumed the chair.

Secretary Whitaker: I have a communication here from Mr. Emilie Cacheux. I have had a translation made, which is as follows:

The Second International Congress of Commercial Fisheries and Oysterculture, under the auspices of the Ministers of Commerce, of Public Instruction, of the Colonies and of the Marine and Agriculture, in conjunction with the Chamber of Commerce of the City of Dieppe, from the 2d to the 6th of September, 1898.

Office of the General Secretary,
25 Quai St. Michel, July 6th, 1898.

To the Secretary of the American Fisheries Society:

I have the honor of addressing you by this mail a pamphlet of our society and a program of the International Congress of Fisheries, which meets at Dieppe from the 2d to the 6th of September next.

We shall be very happy to see your society represented at this Congress, whose prime object will be to effect a preparation for the meeting to be held at Paris in 1900 of the Exposition Universelle.

You are undoubtedly aware that there will be held an International Congress of Fisheries at Bergen, Norway, July 18th to 21st. To avoid a conflict of the several International Congresses it will be necessary to form a permanent committee having charge of the arrangements for this meeting, and we count upon that being done at Dieppe. Can you not bring this matter up at the meeting at Omaha, and ask the several societies that will be there represented to designate some persons to represent them upon this permanent committee for the International Congress? We shall complete the committee at the Dieppe Congress, and will exchange ideas through our respective bulletins.

Accept, my dear sir, the assurances of my highest consideration.

EMILIE CACHEUX.

Mr. Peabody: I move that Professor Birge be appointed to represent the Society in response to the invitation just read, and attend if he can.

Professor Birge: I suggest that the matter be referred to the executive committee that will be appointed at this meeting. Let them correspond and see if they cannot find some of the Eastern men who are interested in the Society and who will consent to represent the Society.

Mr. Clark: A member of this Society, Captain Collins, is probably in Bergen now.

Mr. Whitaker: Captain Collins is not a member. I suggest that the matter be held in abeyance until some future time at this session.

The Chair: Very well, if there is no objection it will be so ordered.

The President announced the following committee on place of next meeting: Mr. Herschel Whitaker, of Michigan; Mr. Calvin Spencley, of Wisconsin, and Mr. J. A. Dale, of Pennsylvania.

President: Is the Auditing Committee ready to report?

Mr. Spencley:, chairman of the Auditing Committee, submitted the following:

To the American Fisheries Society:

Your committee, appointed to audit the report of the Treasurer of the society, beg leave to report:

That they have carefully examined the same and the accompanying vouchers and found the same correct in all respects and they find that the balance in the hands of the Treasurer at the date of said report was the sum of $401.26.

They further recommend that the society tender to the Treasurer a vote of thanks for the great zeal he has used in collecting the dues from the members of the society, which has resulted in the present very satisfactory state of your society's finances.

CALVERT SPENCLEY,
JAS. A. DALE,
J. E. GUNCKEL.

President May: What is your pleasure as to the report of that committee?

Mr. Clark: I move you that the report of the committee be accepted and adopted.

The motion was seconded and unanimously carried.

Mr. Dale: I beg leave to submit the following majority report of the committee on the reduction of dues:

A discussion before the Auditing Committee in regard to the reduction of the dues of the society was participated in by a large number of the members. The majority of the Auditing Committee beg leave to report that they believe a reduction at this date of the dues to $2.00 a year would be sufficient to sustain the financial work of the society and add greatly to its membership.

The committee would also suggest that a certificate of membership in the association be procured.

JAS. A. DALE,
J. E. GUNCKEL.

Mr. Spencley submitted the following minority report:

To the American Fisheries Society:

As a member of your committee, to whom was referred the question of the advisability of reducing the dues for membership and the amount of annual dues, I beg leave to make a minority report.

I am satisfied, after a careful consideration of all that was said before the committee on the subject, that it would be for the interests of the society to reduce such membership fee and annual dues to the sum of $1.00.

I believe that this would very greatly add to the membership of the society and the attendance at its meetings and that its influence and importance would be thereby greatly increased. I am satisfied that the addition to our membership would be so great that the annual dues of $1.00 would be ample to provide for all the expenses of the society, and would, in fact, produce a greater revenue than the present dues of $3.00 or even of the $2.00 fee recommended by the majority of the committee.

All of which is respectfully submitted.

CALVERT SPENCLEY.

Mr. Spencley: I beg leave to move its adoption.

Mr. Peabody: I will second the motion.

Prof. Birge: I move that both reports be laid on the table and be made a special order for the meeting of 1899.

Mr. Spencley: I hope that motion will not be pressed by Prof. Birge. I think that is a matter that should be considered now. If Prof. Birge's motion prevails it will simply cut off all debate.

Prof. Birge: I will withdraw the motion if you desire to discuss it.

Mr. Nevin then seconded the motion to adopt the minority report.

Mr. Stranahan: What are we to understand as to the powers we have; have we the power to change these fees or dues with our present membership?

Secretary Whitaker then read the constitution as to the point in question.

President May: Under the constitution we have the right to change the amount of dues, and fifteen members being present two-thirds will be sufficient to make the change.

Mr. Clark: What is the question before us?

President May: The question before the house is on the adoption of the minority report.

Mr. Clark: I move as an amendment that the minority report be laid upon the table and that a committee of five members be appointed to report upon this matter at our meeting in 1899.

Mr. Whitaker: I second Mr. Clark's amendment.

President May: The amendment is in order. The amendment is to lay on the table; that does not admit of debate.

The motion was put by President May and as the vote seemed to be in doubt, a division of the house was called for. A rising vote was taken, resulting in the amendment being lost.

The President: The question now occurs on the original motion, which is on the adoption of the minority report.

Mr. Spencley then discussed the minority report, advocating its adoption.

Mr. Whitaker opposed the adoption of the minority report.

Mr. Clark: I wish to be on record in this matter in the report. I desire to say that I am opposed to the reduction of the dues at this time and the motion that I made to lay this minority report upon the table and appointing a committee would probably accomplish the same thing. I want to say that I want to have other members have some voice. I want to be put on record as opposing the reduction of the dues.

President May: Are there any further remarks? If not, we will call the roll on the adoption of the minority report.

A roll call was had, resulting in fifteen votes being cast; ten voting in the affirmative and five in the negative.

Two-thirds having voted affirmatively, the minority report was declared adopted and the dues were reduced to $1.00 per year.

Mr. Peabody: I understand this refers to next year.

Mr. Spencley: That is a proper question to settle, whether it should apply to the present year or the future. It is not mentioned in the report.

Mr. Peabody: I would move that this do not apply to the dues for the past year, but to membership dues for the coming year.

Mr. Clark: It occurs to me, now that we have voted on this, that I am very much inclined to think that it should apply at once. I move to amend, that this resolution just passed shall apply to all members who shall join this association to-day or during this meeting and to all dues that are due to-day.

The motion was duly seconded and carried.

Mr. Whitaker: I move you, in order to keep the finances of the society straight, that the Secretary be directed to return to the persons whose applications with full fee are in to-day, the difference between the one dollar and three dollar fee for dues.

The motion was duly seconded and unanimously carried, and it was so ordered.

Mr. Dale: I move you that the chair appoint a committee of ten members on the increase of the society, and that the gentlemen who moved the adoption of this report to reduce the fee to one dollar, be the members of that committee.

The motion was seconded.

President May: It has been moved and seconded that a committee of ten to secure new memberships be appointed by the chair.

Mr. Spensley: I move to amend; that all members of the society be appointed on that committee to endeavor to get new members.

The amendment was duly seconded and unanimously carried.

Mr. Gunckel: If it is the proper time to make a motion that a committee be appointed to select officers for the coming year, I would make a motion that the chair appoint a committee of five members for that purpose.

The motion was duly seconded and carried.

President May: I will announce that committee later.

Secretary Whitaker: The first paper in order on the program, is a paper by Mr. James Nevin, Superintendent of the Wisconsin Fish Commission.

Mr. Nevin read the following paper:

ARTIFICIAL PROPAGATION VERSUS A CLOSE SEASON FOR THE GREAT LAKES.

Inasmuch as some of the states have passed laws making a close season for fishing on the Great Lakes during the spawning season of certain kinds of fish, expecting thereby to accomplish greater results in increasing the supply of fish thus protected than is derived from artificial propagation, I am impelled to devote my paper, for the most part, to an expression of my views of the relative value of the two methods of increasing the supply of valuable food fishes in those lakes. It is true that both methods may be employed in the Great Lakes at the same time, and perhaps with good results; but if both are employed at the same time in the same waters, if the desired increase of fish be forthcoming, the question will then arise as to which method we are to attribute the results; and in consequence it may end in the abandonment of one method for the other, and possibly in the uncertainty of the case, the abandonment of the method which has done the most to bring to us the desired increase of fish. For this reason, it seems apropos at this time, that a discussion and investigation of both methods be made here and now relative to the results which have been obtained from both methods as employed in the past at different points, together with a presentation of the arguments for and against both methods. We have considerable knowledge of both methods and know something of the apparent results from each. We have the experience of practical men and the conclusions they have drawn, pro and con, which we may discuss here at this time; and thus place on the records of the American Fisheries Society our views and our knowledge of these matters; which may be of benefit or at least of interest to those who take up the work of fish culture after it has passed from our hands and "Old Time" has applied his scythe to the line which binds us to our vocation.

Personally I have been on the various spawning grounds of the whole chain of Great Lakes from the Gulf of St. Lawrence to Lake Superior during the spawning seasons; and I have many times watched the salmon trout, whitefish and wall-eyed pike spawn in their natural way; and I am convinced that only a very small percentage of the eggs so deposited are fertilized. If as large a number of eggs as is claimed by some people are fertilized in the natural process, I inquire, what becomes of the fish after they are hatched? When we come to take into consideration the number of eggs that each female whitefish, lake trout and wall-eyed pike will produce, we may well make this inquiry. A four-pound whitefish will produce 50,000 eggs; a six-pound lake trout, 8,000, and a five-pound wall-eyed pike about 100,000. These figures, considered in connection with the vast number of fish of various kinds in the lakes, require no backing with argument to justify the question, "What becomes of the fish after they are hatched?"

Some years ago I had an interesting and profitable experience watching whitefish spawn in ponds on the Detroit river. The female fish would come to the top of the water and throw her eggs whether there was a male fish in her vicinity or not. To me it seems impossible that the male fish can fertilize one egg in a million that are thrown off by the female, when I know that it is absolutely necessary that the milt come in contact with the eggs immediately after they are thrown off by the female and while the micropyle is open to receive it; and considering the small amount of milt possessed by the male and the manner in which it is thrown off into a large body of water.

Another circumstance that confirms me in my belief as to the small number of eggs fertilized by the natural process is the order in which the male and female fish come on to their spawning beds. In the Great Lakes, the first run of fish in spawning time is composed almost exclusively of male fish. They are followed in a few days by the females; and in taking spawn from this second run of fish, we find that seven-tenths of the fish taken are females; and it is a difficult matter to get enough male fish to fertilize the eggs taken. It frequently occurs that pails full of eggs are thrown overboard because enough male fish cannot be procured to impregnate them. A few days after the run of females has passed off, a run of small male fish comes on. I have heard many people say that this run of male fish will fecundate the eggs of the earlier run of females. But those of us who have had experience in practical work know that the eggs cannot be fertilized after they have left the fish two hours. However, assuming that a part of the eggs become fertilized, they must of necessity be lodged among those which are not fertilized and consequently, the fungus growth, with which all fish culturists are familiar, spreads over the entire mass, and the percentage that hatches must be very small. The only way that suggests itself to me that will ever enable us to form an accurate idea or obtain positive knowledge of the number of whitefish eggs impregnated naturally is to have a diver go down on the reefs and bars just after the fish get done spawning, and gather up a few gallons of eggs, which may be placed in a hatchery and the results noted.

Last fall I spent three half-days on a trout stream and examined numerous spawning beds at the time the trout were spawning in the stream. I had such apparatus as I thought necessary to obtain any eggs that might be on the beds, but we did not find a single egg in any nest that we examined. I presume the eggs had been devoured by the trout as fast as deposited. My purpose was to find the percentage of trout eggs impregnated by the natural process. I shall follow up this work again this fall and hope for better results.

There are very few good trout streams in which less than one thousand trout spawn naturally each year. These trout should average at least two hundred eggs each, making two hundred thousand eggs deposited in the stream each year. If five thousand trout are hatched and come to maturity, this should certainly be enough to keep the stream well stocked, under the protection of a close season eight months in the year. But our experience teaches us that it does not matter how well a stream is stocked, if it is fished for two or three seasons, fry must be supplied from the hatcheries if it is to continue to produce good fishing.

I have done some figuring on my own account to get at the number of whitefish eggs, deposited naturally, required to produce one mature fish weighing two and one-half pounds. I have taken the whole number of pounds whitefish caught on the chain of Great Lakes, that is, Lakes Superior, Huron, Michigan, St. Clair, Georgian Bay and Lake Erie (not including fish taken from Lake Erie in Pennsylvania and Ohio waters), which in 1896 was 8,223,900 pounds. Estimating that each fish taken weighed two and one-half pounds, we find that 3,289,560 whitefish were caught. Estimating that there were left in the water three times as many fish as were taken out and that six-thirteenths of the fish are females (I believe that most practical fishermen will agree that these estimates are low), we find that there were 4,554,747 female fish producing eggs. Allowing an average of 30,000 eggs for each female, we find that 136,642,220,000 eggs were deposited naturally and produced only 3,289,560 mature fish. Thus we find that of 41,568 eggs deposited naturally, only one fish comes to maturity. Of course, many things must be taken into consideration in making these estimates; and at best the estimates as well as the results obtained are barely approximate. Yet it gives us something of an idea of the vast number of eggs that must be deposited in the natural process to produce a single mature fish. In making these figures no account is made of the millions of whitefish fry annually planted by the several states and the United States.

Thus after spending twenty-five years in the work of fish culture and propagation, I cannot but conclude that an enormous loss of fish of nearly all species occurs in the egg stage, because the eggs deposited by the female are not fertilized. The result is, our streams and lakes become depleted of fish within a short time after men with modern fishing apparatus begin to take fish from the waters for food. Nature's provisions for the survival and increase of the several species of fish are not adequate. To rectify this apparent error in nature's laws, we have resorted to artificial propagation with gratifying results. That we still have much to learn in this work, we all agree. But at the same time, I believe that all fish culturists and those whose knowledge of the subject qualifies them to speak intelligently of it, will admit the complete success of artificial propagation with many species of fish. I refer particularly to the stocking of our Wisconsin streams, once barren, with brook and rainbow trout; and the planting of shad in the rivers of the Atlantic and Pacific coasts, facts with which we are all familiar. A few years ago shad were unknown on the Pacific coast. A few thousand fry were taken from New York State and planted there. To-day shad are as plentiful on the Pacific coast as on the Atlantic. The planting of salmon fry in the rivers of the Pacific coast has done wonders in the way of increasing the salmon. Many other species have been made to increase and multiply very rapidly.

That whitefish eggs can be hatched artificially in large numbers, there is no question; and I hold that given suitable planting grounds on which the proper food is found in sufficient quantities, and protection to the small partly-grown whitefish until they come to maturity, there is no reason why we should not have the same success in maintaining the supply of these fish as we have had with others.

Our experience with the inland lake whitefish in Wisconsin has demonstrated this to our satisfaction. In 1889 and 1890, a large number of inland lake-whitefish fry was planted in Chequamegon Bay. The eggs from which these fish were hatched were taken from Lake Mendota, at Madison. In about three years after the fry was planted, the fish began to show up to good advantage and are now taken by tons in Lake Superior. This seems to us good evidence of what can be done by artificial propagation, where the waters into which the fish are introduced are naturally adapted to them.

Relative to the operation of laws providing for a close season on the Great Lakes, I call attention to the Province of Ontario, Dominion of Canada. The Province of Ontario has had a close season for the fish of the Great Lakes for the past twenty-five years. The fish protective laws are much more rigidly enforced on the Canadian side of the Great Lakes than on our side. The fishermen operate under a license system. The number of boats and nets that may be used is limited. The number of pound nets which may be set in a string, the number of strings in a locality, the size of the mesh, and the manner in which they may be set in channels, etc., are all carefully prescribed. Each fisherman is limited to certain specified grounds, and he is not permitted to fish on any other grounds than those allotted him; nor are other fishermen permitted to fish on the territory assigned to him.

This feature of the law operates very decidedly to protect the fish in many instances where the fish run in large numbers to certain localities at certain times of the season or year. In such instances, the fisherman having the right to fish in the locality where the run is large, can only fish the number of nets allowed him in his license, and his neighbors are not permitted to set their nets on his grounds; and many fish which would be taken if a larger number of nets were set, escape. To illustrate this point, I have seen as many as eight tugs fishing on one small reef, and occupying so small a territory that the nets of the different tugs were crossed and recrossed several times.

Recently I have gone through the several annual reports of the Fisheries Department of the Dominion of Canada to find the results of their close season for twenty-five years on the catch of whitefish for the Province of Ontario from Lakes Superior, Huron, Erie, St. Claire, Georgian Bay and the Detroit River. I have compared the catch of whitefish in the Province of Ontario with the catch from the same waters in the State of Michigan, which has less coast line than Ontario and has not had a close season until this year.

From the last Biennial Report of the Commissioners of Fisheries of the State of Michigan, I learn that from the year 1891 to 1895 there was a decrease of 58 6-10% in the catch of whitefish in that State. In the Province of Ontario, I find that during the same period there was a decrease of 58 5-10% in the catch of whitefish. This is approximately the same rate of decrease as in Michigan, notwithstanding the fact that the number of nets used in Ontario increased, during this period, 32 3-5% as against an increase of only 9 1-5% in Michigan. In this connection, it should also be remembered that Michigan has never afforded anything like adequate protection to the small whitefish, while the more rigorous Canadian laws have given very efficient protection to these small fish. When I consider the large quantities of small immature whitefish that have been taken with pound nets during the last twenty years, I often wonder that there are any whitefish left in the waters. In the Michigan waters under consideration, I find that 1,588 pound nets were in use in 1895; no restrictions being placed on the number of nets in a string, or the number of strings in a locality. During the same year in the same waters in Ontario, there were only 342 pound nets in use, and they were restricted as I have indicated above.

Tons of small whitefish are caught yearly from Michigan waters with pound nets; and a large part of them are sold for herring and listed in the Michigan fish statistics as herring. To bear me out on these points, I quote from the report of Mr. C. H. Moore, statistical agent of the Michigan Fish Commission, who furnishes numerous letters from fishermen and other data to substantiate his statements. Mr. Moore says: "Of the 1,717,-220 pounds of whitefish caught in this district (No. 5) in 1895, 470,000 pounds (27%) were immature fish and every ground in this district fished with pound nets furnished a portion of this amount of small whitefish in greater or less quantities, but more notably so at Marquette and Detour, where liberal plants of whitefish have been made during the past five years. In this district as well as in the others, the use of the pound net is the chief device in the destruction of the young whitefish."

"At all the above stations small whitefish are taken, and the fishermen in reporting their annual catches, put them under the guise of herring.

"The catch of immature fish and the wasteful manner of fishing practiced by the fishermen throughout Michigan's entire coast, especially where pound nets are fished, is a matter of great concern, and is doing more than any one thing to deplete the Great Lakes of whitefish and must ultimately ruin the fisheries of the State." In contradistinction to this state of affairs in Michigan waters, I find but one or two instances in the reports of the fishery overseers of the Canadian fisheries where mention is made of immature whitefish being taken in Ontario waters, in which, as I have shown, only a limited number of pound nets are used.

If the young whitefish caught in Michigan waters and listed in Michigan statistics as herring were properly listed in those statistics, Michigan's apparent annual catch of whitefish would be considerably increased.

It is evident, then, that the whitefish caught in Canadian waters are, by virtue of good laws, well enforced, larger and average a greater weight per fish than those caught in Michigan waters; and it follows that for the same number of pounds of whitefish in the aggregate, Michigan waters produce many more whitefish than are produced in the same waters in Ontario. It should be noted here, too, that Michigan's annual catch of whitefish from the waters under consideration is larger in the aggregate of pounds than the catch from Ontario waters, although Michigan has less coast line on those waters than Ontario.

Thus, on the whole, we get a showing very favorable to Michigan waters with fishing the year round as against Ontario with a close season of twenty-five years' standing. I firmly believe that this favorable showing for the Michigan waters is due to the fact that the Canadian Government has not planted as many whitefish fry in the waters which we have been considering as the Michigan Fish Commission has planted.

What has been said of depleting our waters of whitefish by catching the young immature fish, is also true of lake trout, though the manner of taking the small lake trout is different. During the last few years the fishermen have found it profitable to reduce the size of the mesh of the gill nets used in catching chubs, blue-fin, and herring. With these small meshed nets, they are catching large quantities of small, undersized lake trout. This should not be permitted to continue if we are to keep the lake trout in our waters and on the market as a commercial fish for future generations.

The conditions existing in Michigan waters in relation to a close season, the planting of whitefish fry, and the taking of small whitefish and lake trout, as herein set forth, apply with equal force to Wisconsin waters.

Last year I had the pleasure of taking a trip up Lake Winnipeg and looking over the fishing industry, picking up what information I could relative to fish and fishing on that lake.

Taking into consideration the laws in force relative to catching whitefish, to an onlooker, it would seem that the whitefish could never be exterminated from Lake Winnipeg. No pound nets are permitted in the lake, and no gill nets of less than five and one-half inches mesh. Fishing with nets is not allowed within ten miles of the mouth of any river. All nets are taken out of the water on Saturday and are not reset until the following Monday. No small fish are caught. The whitefish caught will average four pounds each. The government permits but a certain number of fathoms of nets in the lake at one time, and these must be set on certain grounds.

With these restrictions on fishing, it would seem that this lake should be productive of whitefish for all time to come. However, such does not appear to be the case. In talking with the foreman of one of the fish companies at Selkirk, I asked him if whitefish are as numerous now as when he first went there, which was some twelve years ago. He replied: "When I first came up here, we would go out in the lake with a tug, and I would hold up my fingers to the Indians to indicate the number of fish that I wanted. Every finger that I held up would mean one hundred fish, and they were off with their canoes and dipnets and would get us all the fish we could carry on the tug.

To-day, our tugs go up on the fishing grounds, some two or three hundred miles, to get their supply of fish."

The decrease in the number of fish caught in certain parts of the lake became so perceptible that in 1890 the government appointed a commission to go to Lake Winnipeg and investigate, to find the cause, if possible. At this time the use of nets having five-inch mesh was permitted, but the fishermen preferred to use nets of five and one-half inches mesh. It cannot, therefore, be said that they were catching large quantities of small whitefish with small meshed nets. This decline in the catch of whitefish was and is taking place under a close season which has been in force several years.

Boys who began chasing whitefish on Lake Ontario, then on Lake Erie, Huron, Michigan and Superior, you will find to-day as aged, white-haired men, still chasing whitefish on Lake Winnipeg.

If the government does not soon begin to plant large numbers of whitefish fry in this lake, in another decade the whitefish of Lake Winnipeg will be a thing of the past, in spite of the close season and the stringent laws which they enforce for their protection.

I consider the close season for fishing on the Great Lakes as being in the interest of the syndicate of fish dealers, who, while the fishing is closed for thirty days, are given an opportunity to dispose of their frozen fish which they have stored in their freezers in the northwest, to the disadvantage of the small fishermen on the lakes.

I believe that if it were not for the liberal planting of whitefish fry in the Great Lakes, the whitefish would have been practically exterminated years since. What we need is protection for the small fish; and artificial propagation will keep the lakes and streams well supplied with desirable food fish.

Secretary Whitaker: So as to correct the record, I desire to say that Mr. Nevin has made an error in his figures, so far as Michigan is concerned, as to the decrease or dropping off of whitefish. In 1885 the statistics were taken by a man who was very thorough in what he did, but he didn't begin to cover the territory that has since been covered by the man now in charge; the figures of 1885 didn't show the total catch of that year. The catch of whitefish in 1885, as shown, was something over 8,000,000 pounds; the last report shows something like 3,000,000 and some pounds. It has been going down rapidly. Mr. Nevin has made a mistake in his figures.

Prof. Birge: Your year would be 1885; Mr. Nevin's report is as to 1893.

Mr. Whitaker: Of course all the value there is in statistics is to show the exact facts. If you will take 1885 and other years that we have reports of clear down to 1895, you will see that the figures show a decrease of whitefish each year reported down to 1895, when it was 3,353,187 pounds, showing a very much larger per cent. of decrease than would be indicated by your figures. You don't take your figures far enough down to show the effect of it. I fancy Michigan has been the largest planter of whitefish in this country, yet we find an enormous decrease in the catch. It is necessary that something be done to arrest this. Statistics are valuable so far as they go, but you cannot draw from the facts what Mr. Nevin seeks to show, that the loss or decrease is not so great in Michigan as in Canada waters and that planting under present conditions has sustained the catch in our waters.

Mr. Spencley: Wouldn't the same conditions exist in 1885?

Mr. Whitaker: Yes, but what I say is, that the statistics did not cover the waters as completely in 1885 as they have since 1891. I believe in hatching whitefish; Michigan has done as much as she could, and she has had the assistance of the United States in that work, yet notwithstanding the immense numbers of whitefish planted, the falling off in catch has been enormous.

Mr. Clark: I have a short paper and after hearing Mr. Nevin's paper, I want to say that my paper treats upon this same subject; that is, in a general way. Before any general discussion is had, I think it would save time to present it, and perhaps others. Wouldn't it be better to present the papers pertaining to this subject and then take up the discussion? I would like to present my paper now and then have the discussions.

Prof. Birge: I move that the papers that deal with the subject of fish propagation be taken up now.

President May: I want to announce the committee on the nomination of officers. The committee will be Mr. Gunckel, of Ohio; Mr. Dale, of Pennsylvania; Mr. Whitaker, of Michigan; Mr. Spencley, of Wisconsin, and Mr. Clark, of the United States Fish Commission.

Mr. Dale, chairman of the Executive Committee, presented the following names for membership and reported a recommendation that they be accepted, and moved the adoption of the report.

The names presented are as follows: D. Lydell, Mill Creek, Mich.; H. H. Marks, Paris, Mich.; J. P. Marks, Paris, Mich.; A. C. Babbitt, Sault Ste. Marie, Mich.; J. W. Powers, Paris, Mich.; H. B. Stranahan, Cleveland, O.; F. F. Stranahan, Cleveland, O.; F. A. Stranahan, Cleveland, O.; E. M. Ball, Put-in-Bay, O.

The motion carried and the candidates were elected.

Mr. Clark then read a paper on "Notes in Connection with the United States Fish Hatcheries in Michigan," which follows:

NOTES IN CONNECTION WITH THE UNITED STATES FISH HATCHERIES IN MICHIGAN.

At the twenty-sixth annual meeting of this society a paper was presented by Mr. Titcomb, of Vermont, on "Wild Brook Trout Spawn." In connection with that paper there was a discussion with reference to the facts presented in all their aspects, and mention was made by me in this discussion of our work of collecting wild brook trout spawn on the Au Sable river in Michigan, a stream formerly known as one of the greatest grayling streams of the United States, but now stocked with brook and rainbow trout. Thinking that perhaps some notes in connection with this work might be of interest to the members of the society, I will lay them before you.

First, however, let me answer the question asked last year by Mr. Bryant, of Wisconsin, as to the difference between fry from eggs taken from wild trout and the fry from the eggs of domesticated trout, whether there was any difference in their vitality, growth, etc. In this connection I would say that 5,000 fry from the wild trout eggs for the season of 1898, after being fed three months on liver and obtaining the length of 2½ to 3 inches, were placed in a spring at the Northville hatchery, where they were subjected to the same environments that they would be in a natural stream or pond; or in other words, they have received from that time up to the present writing no artificial food and they were placed in the spring the fore part of June. From all observations, which have been made practically daily, these trout are doing remarkably well and not a single dead fry has been found. It is, of course, possible that some of them may have died and become fouled in the moss and weeds of the spring, but from the showing at the present time, there is probably the larger percentage of them alive and healthy.

These trout have now been in the spring about forty-five days and are assuming a different color from those that are being fed on liver; the tails and fins are becoming highly colored. I think this also partly settles one of the mooted questions in reference to planting partially-reared fish, that fish raised on liver from six to eight months and then planted, would starve to death before they would accustom themselves to their changed environment and to finding their own natural food. So much in answer to the question that I was unable to answer a year ago. Now to our work of collecting wild brook trout for spawning purposes, on the Au Sable river. This was undertaken by the United States Fish Commission in the fall of 1895; men were dispatched to this river late in August and a camp was formed on a branch that had been previously leased by the United States Fish Commission for the purpose of building ponds for temporary use for holding trout. I quote from the report to the United States Fish Commission in reference to these ponds:

"A dam was thrown across the stream and 100 feet above a screen was built to prevent the fish from escaping in that direction. This dam was simply constructed, being built of mud, sand and turf banked up, and had a frame sluiceway 3 feet long, 2 feet wide and 2 feet deep, with the necessary double screen put in the overflow to prevent the passage of fish below, making an inclosure about 100 feet long by an average width of 12 to 15 feet. This inclosure accommodates about 10,000 fish."

The fishing was commenced with rod and line soon after the camp was established, and occasionally with the seine, to collect fish in that manner. The rod fishing was continued until about the 1st of October, when the trout commenced running on the beds, and then the seine was used exclusively.

The first season there were taken from the stream by rod and line and also by the seine, upwards of 6,000 trout; from these in the neighborhood of 400,000 eggs were taken; the first eggs being taken about the 1st of October. These were placed in troughs that had been previously arranged.

As soon as ripe fish are found among those caught on the spawning beds, the pond is hauled with a seine and the fish are looked over twice a week until all the eggs are taken. When the season is fairly opened the spawn may be taken from most of the fish immediately after they are caught, thus obviating the difficulty of transferring them from the point of capture to the pond; in some cases a distance of three or four miles. I quote from my former report in describing the troughs used:

"The water is received through two one-inch orifices in a bulkhead about nine feet long, situated at the head of these troughs and fed by a roughly-constructed raceway leading from a small spring about six rods distant on the hillside. The water from each of the openings feeds two troughs so placed that the lower end of the upper one rests upon the head of the other, thus creating a fall of nearly the height of the troughs. Each trough is 14 feet long, 5 inches deep, and consists of a double row of boxes; each box 17 inches long, 15 inches broad and 2 inches deep, giving a capacity of from 8,000 to 10,000 eggs."

As this was an experimental year for this work, the experiments made were noted, and one very important and essential matter in connection with this work was that conclusions in regard to the experiments were very positively determined.

The eggs, after being eyed, were transferred to the Northville Station. On one of the trips in transferring eggs an experiment was made in connection with moving eggs at different ages; from those freshly taken, to the twenty-second day. From these experiments it was definitely concluded and positively proved that in moving brook-trout eggs at this stage they should be moved not later than the eighth day, inasmuch as those moved between the eighth and eighteenth days were practically a total loss.

From these experiments we came to the conclusion that all eggs taken on the Au Sable River at least, should be moved as soon after taking as possible or held until the eyes plainly show.

In the season of 1897, thinking that fully as many eggs would be obtained without using the rod and line, our men were not placed on the Au Sable until the latter part of September, and the work was begun with the seine about the 25th of that month. From that time until the middle of November there were upwards of 10,000 fish taken, probably all of them with the seine. The eggs were dispatched to Northville within a few days after they were taken from the fish, and in some instances the day they were taken, and in no case were they allowed to be older than eight days.

Our success in obtaining a good percentage of wild brook-trout eggs was not as marked as that reported by Mr Titcomb at the meeting last year; we were not able to obtain over 70 per cent. of good eggs; possibly had they been carried forward to the eyed stage on the Au Sable River they would have done somewhat better. In my opinion, it is not possible to remove wild brook-trout eggs from the Au Sable River and have as high a hatching percentage as is secured from domesticated fish in ponds. At least, that has been our experience on this river. And yet, the Au Sable River is probably one of the best-adapted streams for a work of this kind in the United States; the only drawback, if any, is the small size of the fish.

From the experience and observation of all practical fish-culturists, it has been concluded that not more than 5 per cent. of brook-trout eggs are hatched in a state of nature. Our observations on the Au Sable River have verified this. It is impossible for a large percentage of eggs to be impregnated in the rapid water of that stream. Impregnation is not only more difficult for this reason, but the rapid action of the water, in addition to that of the fish, often covers many of the eggs with gravel to such an extent that they are smothered; while large quantities of those not thus destroyed are subsequently eaten by the fish. In our work we took from 400,000 to 500,000 eggs. If these had been left in their natural element not more than 25,000, or at most 40,000, would have hatched, whereas by artificial impregnation and culture, at least 70 per cent. were preserved, resulting in from 280,000 to 350,000 fry. Of these, 100,000 were planted back in the Au Sable River and its branches this season. From this it will be seen that it is not only practicable and of great advantage to take the eggs from the wild fish, hatch and plant them again, but that the very stream from which they were taken this season is better stocked, to the extent of about 60,000 or 70,000 fry than it would have been if the eggs had not been removed, and this does not take into consideration the several hundred thousands that have been planted elsewhere. Nature, both in forest and stream, notwithstanding her prodigality, is sufficient for self-maintenance, and under favorable circumstances for gradual development, but as is well known, is not sufficient both for self-maintenance and the supply of man's wants. A stream once stocked and left entirely undisturbed, will not decrease in its number of fish, but will invariably do so if there is an unusual draft upon its resources, either during the entire year or during any number of months of each year. For this reason a partially-closed season is seldom, if ever, sufficient to preserve the desired equilibrium. For this method to be absolutely effectual, the closed season should extend over eleven months of each year, if not the entire twelve. But in my opinion it is not absolutely necessary to close the season during any part of the year; it is only necessary to save and mature the incalculable resources that nature now wastes, and thereby by human assistance enable nature to accomplish that which would otherwise require centuries. If it is ever practicable to take the eggs from the wild fish, impregnate, hatch, and plant them back, open seasons will then be as necessary for the removal of the fish as closed seasons are now supposed to be for their preservation. Indeed, it might even then be possible to remove all restrictions as to the sale of fish. Then, that which is now the sport of the few would become the occupation of many, and the fish that is now a delicacy would be found in any market and on every table.

But even if the artificial hatching of the eggs of wild fish is not yet practicable, it is probable that the closed season is not only not beneficial but in some cases detrimental even under present circumstances. With some classes of fish, it is better, far better, to leave the season entirely open, restrict the taking of fish at all times to those that are mature, and during the spawning months require the deliverance of all ripe fish to the hands of Government and State employes for the preservation of their spawn and the return of the same either as eggs or fry, back to the stream or lake from which they came. This would remove the fish now in the way of growing stock, preserve the food necessary to the young fry, and prevent the destruction of large quantities of eggs now consumed by the matured fish.

But whichever of these plans may be adopted in the near future it is evident that the results of substituting artificial for natural methods is a paying investment, and that we have not only passed beyond the fear that nature's resources may be exhaunted, but we now know that we can multiply them at will and to any extent that humanity may need, provided the means are at hand to obtain the spawn from the fish.

With reference now more particularly to the Au Sable, I have no hesitancy in giving it as my opinion that for an egg-collecting station it is far ahead of any other stream that has come to my notice. The United States Commission or the Michigan Commission should undertake the problem of establishing one of the largest egg-collecting stations in the United States on this river. Ponds and long raceways should be constructed for holding large numbers of parent fish; these may be held from year to year, and no serious obstacle would arise to prevent so doing, in addition to taking wild fish from year to year.

One of the great drawbacks to most fish-cultural establishments has been a limited quantity of water, the station nearly always outgrowing the water supply. This would never be the case were a station established on the Au Sable, as the quantity of water is practically unlimited. It is safe to say 1,000,000 parent fish may there be carried in ponds and raceways if desired.

With a large establishment located on the Au Sable, from 10,000,000 to 20,000,000 eggs may be collected, carried forward to the "eye" stage, then shipped to other fish-cultural stations. This matter has been laid before the Commission, and it is hoped the work may be undertaken, if not by the United States, I should recommend the matter to the Michigan Commission.

Mr. Bower then read a paper by F. B. Dickenson as follows:

THE PROTECTION OF FISH AND A CLOSED SEASON.

From boyhood's days I have been deeply interested in the subject of fish and fishing, but until quite recently, almost wholly from the standpoint of an angler. As an angler, I was seldom brought into contact with fish life during the season of natural reproduction, for I was led to believe that all fish should be let severely alone at breeding time. Quite naturally, therefore, I had little or no opportunity to observe nature's ways and methods of reproduction, nor to compare the results thus obtained with results under the shielding hand and fostering care of man.

But time's changes led me to accept the office of Commissioner of Fisheries for the State of Michigan; a State that not only has within its borders innumerable lakes and streams of unrivalled character, but is itself bordered by more miles of fresh water than any other state or country on earth, except Canada. I soon realized that I had accepted a position of no little responsibility, for, in addition to the thousands of square miles of inland waters that needed attention, important commercial interests must be controlled and conserved by wise legislation.

For a number of years the question of prohibiting fishing on the great lakes during the month of November had been agitated in our legislative halls, the object of which was to allow all of the whitefish and lake trout to spawn naturally. Without investigating for myself, and accepting it as a matter of course that such a measure of prohibition would be wise, I worked earnestly and zealously for the enactment of the present closed season law.

During the controversy that finally resulted in the passage of this law, many points were developed that set me to thinking and investigating, and I have continued to think and to investigate until I am thoroughly convinced that, under the conditions that prevail, this law was a most unwise and untimely measure.

I soon discovered that men with heavy vested interests whose value depended on a continuance of fishing for a long term of years, and who had experienced the benefits derived from artificial propagation, were in favor of open fishing in November, with its accompanying concomitant, artificial propogation. Through much correspondence and by personal interview, I soon learned that experienced fish-breeders and fish-culturists everywhere were a unit in agreeing that the law was a blow at the only possible means by which the fisheries may be indefinitely sustained. I have not found a single practical fish culturist who favors the law.

Fish must be caught during the spawning season to protect their spawn, and as such protection to the spawn makes more than a "Hundred blades of grass to grow where one grew before," such profitable increase should not be handicapped nor put under the ban, but should be encouraged and taken advantage of to the fullest possible limit. With open fishing during the spawning season and means provided for saving the spawn, to be multiplied in hatching results many hundred fold, we were on the right track to restore and maintain our fisheries.

But the introduction of young fish by the millions should be followed up with other measures. Undoubtedly a large percentage of the young fish from hatcheries are destroyed by natural enemies, as are the young hatched from natural spawning grounds. This of course cannot be helped; but for man to step in and become an ally of nature in the destruction of partially grown fish, is an offense that cannot be too severely condemned and penalized.

So far as reproductive results are concerned, where provision is made to save the ova, it matters not whether spawning fish are caught by commercial fishermen, or whether boards of fish commissioners turn themselves into commercial fishermen by hiring the same men and apparatus, employing the same methods and disposing of the fish at the highest market price.

But there are one or two points in connection with the catching of spawning whitefish and lake trout by commercial fishermen, that should be incorporated into law throughout the Great Lakes. For the most part the fishermen are more than willing to save the spawn for hatching, although the work of stripping the fish and caring for the ova involves some labor and expense. Still, commissioners should be empowered to require that the crew of every boat or vessel fishing on spawning grounds, should include at least one expert spawn taker, and a heavy penalty should be laid on a failure to save and fertilize the spawn and turn it over to hatchery agents without expense to the State. If new spawning grounds are discovered, they should be reported at once. In case the spawning fish are caught at inaccessible points, where it is not practical to deliver the ova to hatchery agents, it should be fertilized and returned at once to the spawning shoals. I don't think very much of this plan, however, as unquestionably most of the ova thus deposited is destroyed, but the hatching percentage would be somewhat better than in nature, for nearly perfect fertilization would be obtained. Under the circumstances it would be the best that could be done, certainly much better than to allow it to waste absolutely.

There is another point that would be good law for the Great Lakes and perhaps for other waters. While the catching and marketing of commercial fish should for the most part be left to private enterprise, still the control of this form of public property, the title to which in a wild or natural condition, is vested in the States, should not necessarily be relinquished, and the title extinguished or considered as having been passed at the point of private possession. The public should be empowered to say, through its authorized agents, when the title to public property should pass. This law would enable us to control, for the purpose of holding the breeders a few days in suitable enclosures, wherever practical to do so, to allow the ova to ripen and become available for hatching; then, when stripped of the spawn, turn the adults over to those who caught them.

During the past year I have had considerable correspondence with experienced fish-culturists and investigators, on the subject of a closed spawning season and protective legislation. Recently I addressed several of the old employes of our Commission, asking them to submit a free, candid and unbiased opinion as to the merits or otherwise of a closed spawning season for the whitefish and lake trout of the Great Lakes, and I hereby sumbit their letters in reply:

(From Charles H. Moore, Statistical Agent, Michigan Fish Commission.)

Hon. F. B. Dickerson,
State Fish Commissioner,
Detroit, Mich.

Dear Sir:—It is very gratifying to me that the question of artificial propogation and a closed season are being taken up and the benefit derived from the former to our commercial fisheries, placed where it belongs.

The experience and opinions of men who have fished the waters of our Great Lakes for the past forty years should be of some value, especially so from a practical standpoint. By following this industry year after year, they learn the habits of the various kinds of fish taken from these waters, and know upon what grounds to go to catch them. They become experts in the business. They can tell you where the spawning grounds of the lake trout are and the season of the year the parent fish visit them, also their feeding grounds at other seasons of the year. Of the whitefish they will tell you that they go about the lakes upon their wonted feeding grounds and spawning beds in schools; hence are more easily trailed and more susceptible of capture than are the lake trout.

Those of intelligence and long experience say, too, that the schools of whitefish make about the same tours through the waters each year; therefore they conclude that they are not migratory to any great extent. This theory they sustain in saying that it is a fact that the whitefish are more abundant in portions of the lake where the fry have been more generously distributed.

In the minds of the more intelligent fishermen there is no longer any doubt about the good results of planting. When compared with natural propagation, they will tell you of three very destructive causes that surround the conditions of ova cast in open waters. First, loss by lack of impregnation, which carried on in open water must be very great; second, loss from the horde of spawn eaters that are always found upon the grounds during the spawning season; third, loss from the elements, which means a great deal to the whitefish, as they go upon clean shoal ground to spawn during the rough, stormy season of November. The hatcheries eliminate entirely the last two causes, and practically so the first; therefore the conclusion arrived at is, make the annual output of our hatcheries as large as possible, if the improvement and perpetuation of our fisheries are desired.

The good effect of this work is shown in the improved take of whitefish in '96 and '97 from the Straits of Mackinaw to the Beaver Islands, covering that portion of Lake Michigan where plants of the young fish have been made with more regularity each year than elsewhere. The catch of whitefish upon these grounds for the past three years is as follows :

	No. 1.	No. 2.	No. 3.	Total.
1895	57,250	13,410	40,740	111,400
1896	205,726	31,405	46,753	283,884
1897	366,180	40,820	92,620	499,620

While the increase above shown is essentially true, another feature of the catch is also disclosed, namely: more than one-third of this yearly increased take were immature whitefish, 2's, 3's and under, and has a hundred fold greater effect in their destruction than taking the adult fish from their spawning beds. Could the wasteful catch of the small whitefish be arrested and planting pushed to its fullest extent, I fully believe that the perpetuation and increase of the whitefish in our Great Lakes can be carried to a successful end. On the contrary, if planting is withheld and we rely wholly upon a closed season for their preservation, the schools of whitefish in the waters of our Great Lakes will very soon nearly disappear.

(From H. H. Marks, Overseer of State Fish Car, Michigan Fish Commission.)

Hon. F. B. Dickerson,
Michigan Fish Commission,
Detroit, Mich.

Dear Sir:—In reply to your request for my opinion of the results obtained from planting whitefish, and of a closed season during the spawning time, I will say that the conditions as they are now are all in favor of an open season and artificial propagation.

I base my opinion upon observations for the past ten years, as my position with this Commission as Field Foreman, collecting whitefish and lake trout eggs, has given me the very best opportunity to see the results of planting whitefish by this Commission, and the results obtained by a closed season in Canadian waters. The condition of the fisheries on the Canadian shore of Lake Superior, from Sault Ste. Marie, Ontario, to Pilot Harbor, are a closed season from November 1st to December 1st, a law regulating the size of mesh of both gill and pound nets, a limit to the number of yards of gill nets fished by each tug and sail boat, also a limit upon the number of pound nets fished to a mile of coast, and all of these laws are rigidly enforced. The results to-day are that the fish are diminishing in size and number. These grounds are controlled and fished by one firm, who find it necessary to let the grounds rest after being fished two or three seasons. The results from the closed season and other restrictions are not sufficient to keep the fisheries up so they can be fished profitably.

On the American shore of Lake Superior, for the same distance of coast line, from the Sault to Grand Marais, where the closed season law has never been in force until last year, or the amount of nets limited to tugs or sail boats, nor the number of pound nets limited to the amount of coast line, the grounds are fished by two of the largest firms in the business, besides numerous small ones. These grounds have received large plants of whitefish fry from the Sault Hatchery in the past seven years, and the result is that for three years there has been a large increase in the catch of whitefish on these grounds. Last year I was informed by the fishermen at Whitefish Point that during June and July their catch was larger than it had been for ten years, and there was no doubt that it was from the result of planting, as the fish were different from their usual run of whitefish in Lake Superior. This is easily accounted for and proves conclusively that the whitefish taken from these grounds were planted fish, for the majority of fish planted on these grounds were hatched from eggs taken on the Detroit River, and it is very easy to distinguish a Lake Erie whitefish from those of Lake Superior.

From the results obtained on Lake Superior, where one shore has had a closed season and a number of other restrictions, and the other having the benefit of artificial propagation, but no protection, I have come to the conclusion that the only salvation for the commercial fisheries is the protection of the small fish until they have come to maturity and by artificial propagation. I think I can safely make the statement that Lake Superior has always had a closed season for whitefish, for I know of but a few grounds where whitefish have been taken in November, that were spawning fish. I believe that a majority of the whitefish spawn in the latter part of November and the first part of December, when it is almost an utter impossibility to fish for them.

The argument used by a great many in favor of a closed season is that the fish are not disturbed while spawning. This is true, but as there is only a very small per cent. of the whitefish eggs fertilized naturally, besides having numerous enemies, the chances of ever hatching or coming to maturity are very small. By disturbing the spawning function, however, and running the eggs through a hatchery, 60 to 90 per cent. of the eggs taken are returned to the waters as fry. All of the fish that come to the spawning ground are not taken; many spawn naturally, and as each female produces upwards of 25,000 eggs, if a very small per cent. of the spawn naturally cast would hatch and come to maturity, it would be more than double the amount caught every year.

If the brook trout in the streams protected by a closed season of eight months and until they have come to maturity, will not produce enough fry naturally to keep the streams stocked, how can any one believe or expect a closed season of whitefish and lake trout to keep the Great Lakes stocked?

(From Dwight Lydell, Overseer Fish Hatchery, Mill Creek, Mich.)

Hon. F. B. Dickerson,
Fish Commissioner,
Detroit, Mich.

Dear Sir:—In response to your request for my ideas of our closed season law, I hereby submit what I think of the same.

If we are going to have a closed season for whitefish and lake trout, why not admit at once that the artificial propagation of these fish is a failure, which we know to be false. And if a closed season, for these fish will keep up the supply, why surely it would do the same for every other species of fish that we propagate. The brook trout that are only caught with a hook and line and have a closed season eight months of the year, would soon become nearly extinct in most of our streams, if it were not for the planting of the fry nearly every year. Now, with this fact before us, how can we ever expect a closed season to keep up the supply in our Great Lakes?

A closed season for one month does not cover the spawning season anyway, as the fish in different localities do not spawn at the same time. For example, take the wall-eyed pike of Saginaw Bay and the same of the St. Clair River. In Saginaw Bay they spawn in April, but the St. Clair fish spawn in May. This I know to be true, as I used to finish spawn-taking operations at Saginaw Bay the last of April and go from there to the St. Clair River and commence operations about the 3rd of May, finishing about the 26th of May. This shows why some of our fishermen favor the closed season. You pass a law to prohibit the fishermen at Saginaw Bay from fishing in April and you would hear a howl from that part of the State, but the St. Clair fishermen would pat you on the back and say that law was all right, and just what the State needs. Why? Because their fish would then be the first in the market and would command a good price. Now, just reverse the law and have it for May and you would have all of the Saginaw fishermen climbing over one another to shake your hand. The same thing exists with all species of fish from all over our State. So it is impossible to please or hurt all by a closed season for one month. But when a man, a fisherman I mean, approves of a closed season, you just investigate and you will find that the law does not affect him in his locality, but puts money into his pocket.

The only species of fish that a closed season would help is the black bass, because they fertilize nearly all their eggs, and if not disturbed while on their beds, they will hatch nearly all the eggs and then protect their young until they are able to care for themselves.

If a closed season for the bass, which fertilizes nearly every egg, will not keep up our supply, what can we expect from other species that probably don't fertilize one egg in a hundred, and spawn promiscuously over a considerable area of ground, then pass on and leave the eggs to their fate, to be destroyed by all kinds of enemies? Why did not we the spring we dredged in the Detroit River right over the spawning grounds every day for two weeks, get some good whitefish eggs? We got some poor ones. This work was done long before the time for hatching. If there were any good ones there to start with, they must have died from some cause or other.

I think I could take one pair of whitefish and artificially propagate their eggs and plant the fry in one lake, and you could take five hundred pairs with a closed season in the spawning season in another lake of the same size, and take out 200 adults each year from each lake, and I would have whitefish in my lake when you had forgotten how fish smell.

Then what is the sense of having a closed season for whitefish and lake trout, when every fishing ground in Michigan of any importance is covered with spawn-takers, at the spawning season? Sixty to ninety per cent. of the eggs taken by the Commissioners are fertilized and hatched and returned to the waters in a good, healthy state; when, if left to spawn naturally, they would fertilize only a small per cent, saying nothing about the chances that small per cent. takes of ever hatching.

I think the sooner a fish is taken from the water after it matures the better it is for the young generation, provided you take the adults at the time when you can return a young generation from them; for what food it takes to provide for one adult one day would sustain a number of small ones for a week. And as for catching the whitefish or any other fish, excepting those that make a spawning nest and guard it, like the bass, I say the time to take them is when they are spawning, provided you have spawn-takers on the ground. But even if you haven't the spawn-takers on the ground, the loss to the lake would not be as great as it would if the same fish were taken a week before spawning time, for if taken in the spawning season, some of the eggs have been deposited, but if taken before then they are all lost.

I think our small shore fishermen have it hard enough without closing the season and stopping him from fishing the only time in the year he has a chance to make a cent. You practically drive him out of business and give what he makes to the large firms that have large fishing rigs and tugs to follow the fish back to deep water. And any man after having a few years' experience amongst our fishermen and out on our lakes, and understanding the extraordinary gain in hatching results by passing the spawn through a fish hatchery, can come to but one conclusion, and that is that the time of all times when fishing for whitefish and lake trout should not be prohibited, is the spawning time.

I have always found that all fishermen in their honest hearts believe in the artificial propagation of fish, but there is sometimes a limit to a man's endurance. After being hampered for about so long, they will fight, and when a man fights any old weapon will do if he can only come out on top. Some of the arguments used by the fishermen, although they don't believe them themselves, will take every time with a man that does not thoroughly understand fish culture and the spawning habit of fish in nature. Rather than be hampered every two years they would sacrifice the Fish Commission, but if handled rightly they would be the best friends the Fish Commission ever had.

(From J. W. Powers, Overseer State Fish Hatchery, Paris, Mich.)

Mr. F. B. Dickerson,
Detroit, Mich.

Dear Sir:—The question of a closed season for commercial fishing in our Great Lakes having been referred to me for an opinion I beg leave to submit the following:

It is claimed by those who favor a closed season that the fish will increase in numbers and size under this method of protection. Having been engaged in the artificial propagation of fish for the past twelve years, I am forced to hold an opposite opinion. If you are allowed to take the adult fish during the spawning season, obtain the ova, put it in your hatching house, hatch out from

60 to 85 per cent, then put the fry back on the spawning bed in good condition, can nature compete with this? Most emphatically not.

Now, take the other side of the question: We will let the fish alone to spawn naturally. We all know that the whitefish do not make their beds on the bottom, the same as do many of our inland lake fish. They rise rapidly in the water, letting go their eggs at the same time. The male fish is supposed to rise the same time the female does and fertilize the eggs. In my opinion not 10 per cent. of the eggs come in contact with the milt, or, in other words, get fertilized.

Now these eggs sink to the bottom where they remain 120 to 175 days before any hatch. During this time they are exposed to all their enemies, which are too numerous to mention, to say nothing about the constant moving and shifting and washing from the reefs to sand or mud bottom, to be buried up and lost.

Taking into consideration both methods of propagation, which is most likely to increase our supply of commercial fish? I say most surely artificial propagation and the open season.

Suppose the closed season is going to be the means of restoring the supply of commercial fish in our Great Lakes, why not apply the same remedy to all the waters in the country? We have a closed season on brook, rainbow and brown trout and grayling eight months of each year. Is this sufficient to keep up the supply? No. If it were not for the hundreds of thousands that the Commission hatch and plant in the streams every year, in a few years there would be no need of a closed season, or an open season, for there wouldn't be enough fish left to bother with. And it is my opinion that the closed season for whitefish and lake trout, without the help of artificial planting, will result the same as with brook trout.

(From A. C. Babbitt, Overseer State Fish Hatchery, Sault Ste. Marie, Mich.)

Mr. F. B. Dickerson,
Fish Commissioner,
Detroit, Mich.

Dear Sir:—In response to a request for "fish lines," I enclose a collection that has been accumulating for some time

It is quite interesting to pry into nature's methods and note her supreme efforts at reproduction in nearly all forms of submarine fauna; surpassing anything of the kind on the terrestial sphere. If the magnitude of the effort be surprising, its results, or lack of results, is rather startling.

To illustrate, it will only be necessary to mention a few well-known varieties, beginning with the brook trout, whose habitat is perhaps most isolated—that is, fontinalis has fewer coinhabitants of his domain than do other species inhabiting larger bodies of water, and in consequence fewer obstacles to reproduction are present.

In harmony with its environment, the parent fish is required to make but a moderate effort at procreation, spawning an average of about 800 eggs yearly as a guaranty of the perpetuation of her kind; while the lake trout, whose neighbors are legion, deposits an average of 10,000 ova, showing that the namaycush contends with greater odds. Again, whitefish, of the same genus, living under somewhat similar conditions as the lake trout, are far more prolific in ova, contributing an average of 28,000 eggs annually in her procreative efforts, demonstrating that the species is surrounded, or subject, to still more unfavorable conditions. The sturgeon, representing another genus, deposits about 200,000 ova, while the ling stakes 800,000 eggs that she will inure a posterity.

Notwithstanding this prolificness of ova in these varieties, the net increase is phenominally small, the decimal .002 with brook trout and .000002 in case of the ling would probably more than cover the actual net yearly increae, under strictly normal conditions. It would be impossible to enumerate the different agents of destruction causing such enormous waste; the principal reason, however, is well known to students of nature. Nearly or quite all varieties of fishes are spawn eaters, that is, ova deposited by one species is eagerly sought and devoured by another, the spawning ground of a class becoming in turn feeding grounds for representatives of a different species.

Obviously, depletion of a certain species without a corresponding reduction in numbers of its coinhabitants, would seriously retard nature's recuperative efforts in behalf of the partially exterminated class, as "balance" would be destroyed and unnatural conditions prevail.

As instances of rapid depopulation of virgin waters may be cited two of Michigan's most magnificent streams, the Au Sable and Manistee Rivers. Through a long residence near the head waters of both these streams, whose sources may be compassed in a three-mile walk, I became familiar with their early history.

In 1872 their banks were in a primitive state, their waters teaming with grayling. The character of the Manistee River, with its clean, sandy bed and colorless water, together with the peculiarly local and home-loving instincts of grayling, made it a favorite fishing ground, affording at the same time unrivaled opportunities for the student of fish nature. Possessed of gregarious habits, hundreds of grayling might have been counted in pools of fifty yards in extent. After five seasons' fishing with hook and line, the hundreds of former times were represented by dozens.

During the five years of depletion, natural reproduction had gone on uninterruptedly, the spawning period being covered by a closed season, and logging operations not yet begun—here was the chance of a lifetime to observe nature's powers of rehabilitation. Results have proven conclusively that her best intentions comprehend but little more than restoration of natural waste, that equilibrium may be maintained. Aboriginal man seems to have been provided for in her pristine plan, his simple needs being simply a factor in the maintenance of balance; that civilized man, however, was an unreckoned force there is no room for reasonable doubt.

The Au Sable River of to-day is an unparallel instance of succession of species. In the space of twenty-five years its original stock of grayling—the accumulation of ages—has been practically exterminated and the establishment of brook trout accomplished, to the extent that old-time repleteness has been attained. Rehabilitation has been accomplished, artificially, in thirteen years, dating from 1885, opposed by the same destructive forces that were responsible for the swift depletion of the original species. If man in various ways was responsible for the destruction of a species, he has also been an active agent in the establishment of its successor, to what extent may be left to inference.

Experiences of twenty years devoted to practical fish culture leads me to deduce the following: That, even though fishing operations on the Great Lakes were suspended absolutely, restoration of partially exterminated species to their original numbers, through natural reproduction, would occupy ages. Moral: let nature furnish eggs in the rough; let fishermen provide means for the preservation of immature fish. Hatchery products can do the rest.

A comparison of natural with artificial propagation of fishes, as to results, may shed a ray of light on the efficacy or otherwise of a closed spawning season for whitefish and lake trout; the enforcement of which must necessarily curtail the output of hatcheries.

If natural reproduction be so slight under the most favorable conditions—such favoring state being simply a natural environment—how much less must be procreative results after balance has been destroyed, in the depletion of a species without corresponding reduction in numbers of its coinhabitants; certainly chances against natural reproduction of a class thus depleted would be multiplied—in fact, it will cease to be natural simply for the reason that the run-down species is handicapped by existence of unnatural conditions. Such conditions now prevail.

It is conceded, I think, that the greatest natural waste occurs during the period of incubation; beginning immediately after extrusion of the ova. During this period more than 99 per cent. of whitefish ova is wasted, through destructive agencies, or lack of fecundation. Thus, the procreative efforts of two adult whitefish would probably be represented by less than 100 fry. Now, it seems equally probable that less than 1 per cent. of these fry reach maturity. If it were otherwise, over-production would ensue—that is, if in a pristine state of nature, procreative efforts of fishes duplicate or double their adult numbers yearly, their habitat would quickly become over-populated—in other words, the waters would not hold them. The sequence is obvious—it means that a pair of adult fishes, working under strictly natural conditions, will add less than an average of one representative of their kind yearly, which lives to reach maturity.

Let us now get at approximate results of artificial propagation of whitefish. It is a well-known fact that an average of at least 70 per cent of artificially handled ova from this species hatches. Allowing a loss of 10 per cent. of the fry in transportation and from other causes, leaves 60 per cent. of the entire number of eggs produced by an adult whitefish, to be returned to the waters in the form of vigorous fry. In brief, a pair of mature whitefish taken from their spawning bed, compensate by a return of 16,000 active fry, as a result of artifice.

Now we will consider the chances for and against the maturing of hatchery products. Incubation proceeded, in hatcheries, in water of a natural temperature; the period being neither shorter nor longer than under natural conditions. In transition from hatchery to habitat, the same conditions obtain. Scientific research develops the ubiquity of organic forms, on which the fry of whitefish subsist. Carefully conducted experiments also prove that hatchery products quickly detect such matter, profiting to the extent that substantial growth is quickly apparent. Thus, in the battle for existence, the products of our hatcheries are placed on practically an even footing with naturally hatched fry. To be conservative, however, we will allow that but one in 500 of the vigorous, artificially produced fry, reaches an adult age. This extreme concession will give the handsome net result of 32 full grown whitefish to compensate the removal of two parent fishes from their spawning bed, and subjected to piscicultural art.

If properly supported—in the preservation of immature fishes —there is no question as to the adequacy of artificial propagation in the restoration and future maintenance of the fisheries of the Great Lakes. Such support has been denied; resulting in a steady decline in the productiveness of our fishes. That a remedy for this should be inaugurated is imperative. Of the efficacy of a closed spawning season as such remedy and as a means of restoration and the preservation of immature specimens, it is practically nil. Nature's methods of replenishment produce infinitesimal results, which are of no consequence when opposed to the enormous drain of commercial fishermen.

Young fishes, guided by instinct developed in them by successive stages of growth, do not see spawning grounds while yet immature, but instead, infest food producing ranges, where midsummer fishing with murderous, small-meshed pound nets, is responsible for the destruction of untold thousands of this class; from this cause comes the blight upon propagatory efforts. That fishermen have thus so persistently wrought their own undoing seems incredible.

Instances may be cited where a closed period for the spawning function seems to have produced the good results claimed for it. We will take, for example, the pronounced success of artificial propagation of brook trout. Every one knows that wonders have been accomplished in this direction, but to what success has been due to closed spawning months is, perhaps, not so well known. I cannot but believe that to other existing conditions should be attributed the accomplishment of a major portion of the good effects in brook trout culture. That a closed time affects the saving of adult fish, for the time being, there is no room for doubt; but the infinitesimal results of natural propagation add very little its efficiency as a means of restoration or support. On the other hand, suppose conditions were such as obtain on the Great Lakes, that is, let the enforcement of six-inch limit regulations be discontinued, permitting indiscriminate slaughter, regardless of size. Let the open season extend from March 1st to September 1st. Remove the embargo against the sale of brook trout by interstate laws. Add to this an urgent market and a fair price for brook trout. Contemplate results!

I will say in closing this paper that I give the foregoing letters from men of practical experience for what they are worth. My investigations, I must admit, have educated me in favor of an open season, but I would demand certain restrictions. With no restrictions, and no hatcheries, a closed season is better than nothing. If representatives of the Commission were allowed to go on the boats of the fishermen and take the spawn, without expense to the State; or, in case no representatives of the Commission were present, the fishermen were required by law to strip the mature females and impregnate their spawn and ship it to the hatchery, or when not practical to do so, place it back in the water; and the size of whitefish, lake trout and pike perch be limited to practically mature size; and it be made an offense against the State for fish under these sizes to be found in one's possession, I believe, from the investigations that I have made, that our waters would not be depleted as rapidly as under our present closed season law. On the contrary, I believe a perceptible increase in the fish supply would soon be manifest.

I would also suggest that it be made the duty of Fish Commissions to instruct commercial fishermen in the art of stripping and impregnating the spawn, and that it be the duty of all fishermen to always have in their employ a man who has learned the practical method of stripping, impregnating and handling the eggs. This done, it occurs to me that all fishermen would take a personal and selfish interest in saving every egg possible for the hatcheries.

When fish commissions and fishermen pull hand in hand for the restoration and preservation of our fish supply success will crown their efforts. Let them get together then on some common ground that will be of the greatest good to the greatest number.

Mr. Seymour Bower then read the following paper:

NATURAL VERSUS ASSISTED REPRODUCTION OF CERTAIN KINDS OF FISHES.

If all the members of this society were practical fish-culturists, I should need to apologize for introducing much that is trite and stale to the experienced fish breeder. But a good many of the members, perhaps a majority, have had little or no opportunity of observing nature's plan of reproducing certain forms of water life; hence, to be understood by all, it has seemed necessary to include much that is obvious to the more experienced.

Ages ago, before the advent of man on mother earth, the reproduction of all forms of animal and vegetable life appears to have been so adjusted to environing conditions that the net increase or decrease of any given form or species was imperceptibly slow. Indeed, since natural laws have not changed, we may well believe that centuries, if not ages, must have elapsed before natural evolution insured an abnormal predominance or led to extinction. The universal law then, as it is to-day in strictly wild or natural areas, was that natural increase barely balanced natural losses, so that the various species for the most part merely held their own.

The entrance of primitive man upon the scene, however, was the injection of a mighty factor into the economy of nature's forces, for man was to be a friend and ally of many existing forms, and an enemy of others. Considered merely as an animal, man's advent projected another and a keen competitor into an arena where the struggle for subsistence and existence was already fierce.

But man's mission, although destructive in some ways, was also creative, for his part in the scheme of creation was to conquer and subdue, and outdo nature by harmonizing and pacifying her warring forces. Being endowed with at least the germs of intelligence, he discovered, in course of time, as his numbers increased, that he must of necessity create if he would survive to multiply and replenish the earth; for otherwise, with man as a merely destructive agent, the earth would eventually be divested of all forms of animal and vegetable life available for his subsistence. In course of time, it dawned upon man that God merely pushes the button and man must do the rest—or starve. The Creator furnished the raw material and formulated the inexorable laws governing it; and while man is powerless to create or annihilate a single atom, he is yet endowed with the cunning to so lead and direct the elements and forces of nature, and to so interpret her reproductive methods, as to multiply results many fold.

And thus down through the ages has man waxed mighty in numbers and power; demonstrating and increasing, from time to time, as he grew in intelligence, his superiority over unaided nature's productive power, through discoveries of latent forces and hidden resources, and by ringing new changes and playing new combinations on the various forms of matter.

As unaided nature is barely self-sustaining, she is utterly inadequate to cope with both natural and artificial losses; artificial inroads must be recouped through artificial agencies or depletion, if not extinction, is inevitable. Thus, if the hand of man were to-day withheld, and the primitive, closed-season principle of strictly wild or natural reproduction were applied to all forms of animal and vegetable life, the earth would soon be a desert waste, stripped and depopulated.

It is quite natural, for obvious reasons, that nearly all of the discoveries since man appeared that have contributed to his triumphs over nature in the production of animal and vegetable life, should be confined to land flora and fauna. In the very nature of things we cannot hope to control conditions on water as on land, nor to coax nature's secrets from ocean's depths, or even from more restricted water areas, as easily as on land. Investigation has developed the fact, however, that the same unceasing warfare is waged in the waters as on wild or primitive land areas, and that there is the same inability with the varied forms of life to more than hold their own. As on land, we find that the forces of nature merely balance, that natural gains are checked by natural losses; and that the moment man invades this domain and becomes a factor in the losses without directly or indirectly contributing to the gains, that moment depletion begins.

It was evidently a part of the Divine scheme, however, that the waters should not be depleted, but should remain a fixed and unfailing support for man; for, as with life on land, the means were placed within man's reach whereby he might repay the waters, could make complete restitution, through artificial agencies for all artificial losses. It seems strange that the way for man to thus square himself with the waters, a discovery of such far-reaching importance and significance, should have been overlooked until recent years; for when the Creator provided that many of the forms of water life, in order to survive in nature's environment, must develop thousands upon thousands of germs for each recurring period of reproduction—and each germ a possibility for an adult of its kind—He not only proclaimed the self-evident fact that tremendous odds were to be encountered, but purposely left an opening that was a standing invitation to man to investigate and see if these possibilities could not be converted into probabilities or actualities. And this conversion, by protecting the germs during the germ period, constitutes what is known as artificial propagation—an artificial gain that repays both artificial and natural losses.

And what, it might be asked, has all this to do with laws that prohibit fishing during the spawning season? Of course, this question will not be asked by those who can read words of two and three letters in a fish-cultural primer, for the deductions are obvious, and the application of the general principles laid down, clear and unmistakable.

But right here I wish to digress for a moment and register a vigorous protest, make an emphatic kick, against the further use of the term "artificial propagation," as applied to this method of producing fish. While technically correct, its use is undoubtedly responsible for most of the unwarranted prejudice that exists against this plan of reproduction. To the uninformed the word "artificial" is associated with something wholly at variance with the natural; it suggests the idea that the fish produced in this way are an unnatural substitute, something inferior to, or different from the strictly wild or uncultivated product.

As a matter of fact, there is no more artificiality in the so-called artificial propagation of fish than in a thousand and one other forms of human activity or intervention, or in all forms of production in which the hand and brain of man are a factor in influencing or shaping results. For example, we might, with equal propriety, refer to the ordinary method of raising wheat as the "artificial propagation of wheat" and it would be technically correct to do so.

In the popular mind, fish-culture has too long been discredited and regarded with suspicion through the pernicious influence of this world. We should drop it, throw it off as an incubus, an old man of the sea, that the popular mind may be undeceived and freed from error and prejudice. I earnestly urge all fish-culturists to blacklist it, to strike it from their fish-cultural vocabulary. For myself, I have issued a declaration of independence, turned over a new leaf, sworn off. From now on *protected* propogation is the motto inscribed on my fish-cultural banner.

And now let us return to our fish-cultural kindergarten for a while and try to learn that two and two make four.

In order to propagate fish by protecting their ova, the adults must be caught by fishing in public or private waters during their spawning season. If exposure of the ova in nature's wilds is productive of greater hatching results than to take the ova and protect it from nature's enemies, or if there is no alternative for natural spawning by reason of circumstances forbidding the saving of the ova, then it is wise to stop fishing during the spawning period. If, on the other hand, catching the spawning fish and protecting their ova during the ova stage results in hatching several hundred young fish where only one would hatch without such protection, then it must be clear that the wisest course is to catch the greatest possible number of spawning breeders; that, instead of preventing their capture by law, the greatest freedom and encouragement should be given, in order that this wonderful life-saving process may be employed to the greatest possible extent.

Where open fishing is allowed during the spawning season, and it is practical to save the ova and develop it to the hatching point in hatcheries—as in the case with the trout and whitefish of the Great Lakes—to deliberately close this season against fishing is to assume that the percentage of ova hatched in nature's wilds is something near the result obtained by intercepting the deposit of the ova and shielding it from all forms of natural dangers. Indeed, advocates of a closed spawning season, to be consistent, must regard the wild as superior to protected incubation, for is not the one deliberately chosen to the exclusion of the other? And is not non-interference with natural spawning their slogan, and the avowed object for which the season is closed?

As closed season laws are enacted for the express purpose of allowing natural spawning, let us consider some of the environing conditions into which the ova in nature are thrown.

The hatching point constitutes the dividing line between two important stages or periods of fish life. During the second stage, that of the fish proper, it is literally true that the big fish eat the little ones and eternal vigilance is the price of existence. Still, almost from their entrance into this period they are able to move about with greater or less facility, and thus to some extent elude their pursuers by seeking a cover or refuge; and later on they may develop offensive or defensive powers.

Not so, however, with fish life in the first or ovum stage. Possessed of no powers of locomotion, the germs lie inert and helpless, at the mercy of all the enemies of ova life. Whatever dangers environ must be encountered without powers of resistence, or means of defense or escape. When lying on the reefs and shoals, no human power can intervene to stay the destruction—the terrible gauntlet must be run.

The parent whitefish and lake trout, in common with a large group of fishes, do not protect their spawning beds. They select cleaner and more suitable grounds than some other species, but their concern for the welfare of the germs that they deposit with such lavish prodigality ceases when that function is performed.

Then, the wolves of the waters, lurking and prowling, and with whetted appetite, immediately assemble for the feast that a closed season law sanctions and applauds. The spawning grounds become in turn a feeding range; for without exception the spawning grounds of all kinds of fish that do not guard them, become merely a pasture for others. And why not? The ova of all fish are rich, oily, nutritious, a toothsome dainty for even the pampered palate of man. I imagine that the wolves and buzzards and lizards of the waters are even yet winking the other eye, and making merry, and throwing bouquets at themselves, because the solons of two great States were hoodwinked into exploiting the closed season law as a measure of "protection" to whitefish and lake trout.

Nor is the exposure for a period of 125 to 175 days to the tender mercies of spawn-eating animals the only dangers which whitefish and lake trout ova must encounter in nature. The blasting blight of fungus, penetrating and permeating inert masses of unmanipulated ova is of itself sufficient to destroy all germs not completely isolated in the cavities and crevices of rocks and stones. The ova is visited with still other forms of destruction, but these need not be mentioned.

Beyond question, an overwhelming percentage of the loss in the life history of most fishes that do not guard their spawning beds, occurs during the ovum stage. All things considered, it would be a miracle if one in a hundred survived to the hatching point, and odds of five hundred to one would be quickly taken by the most conservative investigator.

The whitefish casts about 30,000 eggs each spawning period; provides, under perfect conditions, for 30,000 young fish; but in nature's domain, under the counterfeit "protection" afforded by the closed season law, these 30,000 eggs probably hatch less than 100 fish. And yet, such meagre results would doubtless suffice for merely natural losses, a posterity would be insured, and the species would hold its own; but to expect, in addition, that such feeble recuperative powers will honor man's drafts indefinitely without bankruptcy, is to expect to find a Klondike at either end of a rainbow.

Compare the results of this delusive and fallacious scheme of protection with the bona fide protection afforded through open fishing and protected environment for the ova. By this plan a single spawning of the whitefish, 30,000 ova, will produce 15,000 to 27,000 young fish, varying according to circumstances. Allowing that but one in three of the breeders not spawned out when caught is in spawning condition, and still the closed season natural spawning plan of producing whitefish is overwhelmingly outclassed.

But, instead of eagerly seizing the only brief opportunity that is allowed to thus create where nature destroys and save where nature wastes, the law says no, we will blindly turn from this golden opportunity whereby we may not only recoup for the fish removed during this period, but also for those taken at other times, when recompense is impossible.

Masquerading and deceiving, through the seductive influence of the word "protection," the closed season law commits the unpardonable folly of denying the opportunity to intervene and rescue and vitalize millions on millions of germs otherwise doomed to certain destruction. To thus protect by destroying is to add by subtracting and multiply by dividing.

Although the hatching percentage of brook trout in nature is undoubtedly much higher than that of the lake trout and whitefish, yet no better illustration of the pitiful inadequacy of natural propagation need be cited than the trout streams of Michigan. Hundreds of non-indigenous streams were quickly stocked through the agency of protected propagation. Fishing has been limited to hook and line for a season of four months, alternating with a period of eight months' rest. Clearly this was a most favorable opportunity for unaided nature to prove her ability to stand up against nature's losses and the inroads of man; in short, for the closed season propaganda to vindicate itself. Surely a closed spawning season should be more than able to stand the strain of four months' angling if it is expected that the same remedy will sustain the wholesale methods of commercial fishing. But we find that in the more accessible streams the stock soon dwindles, fishing grows poorer, and periodical contributions from the hatcheries, to reinforce nature's feeble efforts, are necessary.

If the natural spawning for which closed season advocates so plausibly contend be the unfailing panacea for toning up and sustaining our commercial fisheries, consistency demands that we close our brook trout hatcheries and rely on the same remedy for the streams, where the conditions are much more favorable for nature to sustain herself. If a new stream or system of streams is to be stocked, transplant a few adults and let nature, with a closed spawning season, do the rest.

No doubt much confusion arises in the lay mind because practical fish-culturists favor an open spawning season for lake trout and whitefish and a closed one for brook trout. If the latter were like the former in their habits and movements at spawning time, open fishing would be the wisest possible plan that could be adopted, for then millions of ova that are now wasted could be saved and hatched, and there would be no necessity of going to the expense and trouble of holding a stock of adults under control the year round for the sole purpose of procuring a supply of ova. But with nature's stock of brook trout, there is no practical way to save the ova, if open fishing were permitted, and hence for wild brook trout there is no alternative for natural spawning. At spawning time the breeders disperse to innumerable brooks, where, if fishing were allowed, they would fall into an indefinite number of hands that could not if they would, save the ova and hatch it.

But lake trout and whitefish, like a good many other species, instead of scattering, concentrate their forces at spawning time. The reproductive instinct assembles the parent stock into schools on a comparatively few well-defined and well-known shoals, thus making it practical to cover all fishing points with experts prepared to save the ripe ova. The expense of holding a breeding stock in constant confinement, as conditions compel us to with brook trout, is rendered wholly unnecessary

It may be noticed, in passing, that when a stock of brook trout are held for breeding purposes, thus giving us an option on propagating them by either natural or protected methods, every possible precaution is taken to prevent the former. According to the closed season creed, we commit the unpardonable sin of "interfering with" and "disturbing" the sacred function of natural spawning. If we followed the creed and allowed the breeders to bed and spawn in the ponds and raceways, the meagre hatch would, if carefully reared, recruit the ranks of the adults, but there wouldn't be any surplus for distribution. By violating the creed, however, and running the ova through a hatchery, the gain in hatching results enables us to distribute a million fish annually from a stock of two or three thousand breeders, and still retain enough to keep up the parent stock. But when we come to whitefish and lake trout the closed season law enforces adherence to the creed plan of merely breaking even, and refuses an option on a plan that is absolutely certain to yield immense gains.

To illustrate the common sense, practical plan of "cropping" certain waters, like similar areas of land, let us note the conditions of whitefish life in Crystal Lake, a beautiful sheet lying in Benzie County, near the shores of Lake Michigan. This lake is one of the very few inland waters of Michigan that contain whitefish, or that are capable of supporting the species in considerable numbers. Judging from the number that assemble on its stony shoals during the spawning month of November, the lake probably contains a stock of twenty to forty tons of adult whitefish. As fishing is limited by law to methods that are ineffective so far as whitefish are concerned, these fish serve no useful purpose, except as their ova and young contribute to the food supply of other and less valuable denizens.

But so far as the production of whitefish is concerned, this fertile area, capable of yielding an annual crop equal to the present matured stock, might as well be so much desert. It is obvious that if all of the adults were removed in any one year the sources of food that sustained them would support a like number the following year, and so on indefinitely. To reap this crop year after year, however, fishing by effective means must be allowed, and a due proportion must be taken from their spawning grounds, so that sufficient ova may be touched by the magic wand of protected propagation to provide for future crops. Each crop must be reaped as fast as matured, else there is no room for a succeeding one. But without protected propagation we would soon reach the last link in the chain; with it we would have the link that unites the ends into an endless circuit.

And what is true of Crystal Lake is true of the Great Lakes and many other waters. The trouble with production in the Great Lakes is that far too many whitefish and trout are slaughtered in immaturity, and too few adults are permitted to reach their spawning grounds to allow the saving grace of protected propagation to be employed on a scale of sufficient magnitude. It seems a great pity that the parent fish when approaching their spawning grounds, heavily laden with ova nearly matured but still worthless for reproductive purposes, should be intercepted. A few days of closed season at this particular time would be the kind of protection that protects. By postponing their capture for a few days, until the spawning grounds were reached, the wanton waste of an untold number of germs might be prevented and, through the magic touch of man, be called into life.

The saving of adults that is claimed for the closed spawning season is more apparent than real, for a season closed at any time, whether by law or the weather, merely postpones their capture. There is no real gain or increase of adults—their numbers are not added to. Thus, the adults that are shielded in November are for the most part caught before the following November. They are protected from capture for the time being, but in so doing we lose the enormous difference in hatching results between natural and protected methods.

A reckless disregard of the principles herein set forth has brought some of the Great Lake fisheries to a point where it may become necessary, for a time, to reap our annual crop of whitefish and lake trout as the farmer does his grain, namely, when the seed is ripe. Thus, if we would open our present closed season and close our present open season, the production of the young, through the agency of protected propagation, would be so greatly increased that but few seasons of this kind of sowing and reaping would be required to increase the annual crop to the highest productive limit. Until this limit was reached the more we would thus reap, the more we could sow, and the more we would thus sow, the more we should reap. With fish as with grain, it is just as essential to reap at the right time in order to be able to sow as to sow at the right time in order to reap.

In the vegetable world we endeavor to destroy or exterminate what is obnoxious by attacking it while it is yet green, but what we would save for reproduction we protect until it is ripe. Thus, the farmer cuts his grain when ripe and his weeds and thistles when green. During most of the year our commercial fish are treated as weeds and thistles, killed off without limit while their seed is green. And then, when the seed is ripe, instead of treating them as grain, the closed season law caps the climax of economic blindness and folly by saying, hands off, these fields of waving gold, nodding and beckoning for the sickle, must remain untouched; the seed must return to mother earth undefiled, the contaminating touch of the hand of man must not supervene, for then the sacred function of reproduction would not be strictly natural!

Under the circumstances, so drastic a measure as closing the entire open season would not of course be wise, nor is it necessary. But to hold on to the present closed season is to "go forward backwards" with accelerated speed. Under the conditions that obtain throughout the Great Lakes, a closed spawning season for whitefish and lake trout is simply suicidal. By a false pretense, like a wolf in sheep's clothing, a closed spawning season for many kinds of fish does not protect but destroys them.

If we haven't enough hatcheries to shelter all the ripe ova available, the remedy is not to force the hatcheries already established to close by preventing the capture of spawning fish, but to provide additional capacity, so that all the ova that it is possible to reach may be transferred from a scene of tumult and anarchy, may be rescued from the riot and chaos of nature's savagery and brought under the beneficent and fostering care of man.

Mr. Whitaker: Before it is overlooked, I think the matter had better be taken up that was laid over, to designate some one to represent this society in response to the letter of Mr. Cacheaux. I present the name of Prof. Birge to represent this society in that capacity.

Mr. Clark: I will say that I am going to try to go to the Paris Exposition.

Mr. Whitaker: I suggest in addition to Prof. Birge, the name of Mr. F. N. Clark to act on that committee.

Mr. Bower: I would suggest also the name of Mr. Whitaker.

Mr. Stranahan: I move that three be appointed—Prof. Birge, Mr. Clark, and Mr. Whitaker—to attend and represent this society on the committee referred to in the communication.

The motion was seconded and carried.

Mr. Whitaker then read a paper by Mr. Livingston Stone, Superintendent of the United States Fish Commission Station, Cape Vincent, N. Y., on "The Origin of the American Fisheries Society," which follows:

THE ORIGIN OF THE AMERICAN FISHERIES SOCIETY.

On the first day of November, 1870, the following call was sent to various persons who were known to be interested in the culture of trout:

"The undersigned, desirous of promoting the interests of fish culture, call a convention of pisciculturists, at the Skating Rink, City of New York, December 20, 1870, at 11 o'clock a. m.

"The design of the convention is consultation for the protection of our interests, and, if thought best, to organize a permanent association.

"(Signed) "W. CLIFT,
"A. S. COLLINS,
"J. H. SLACK,
"F. MATHER,
"L. STONE.

"Mystic Bridge, Ct., November 1, 1870."

This was the very first step taken towards the forming of the American Fish Culturists' Association, now known as the American Fisheries Society.

The prime mover in the issuing of this call was Rev. Mr. W. M. Clift, of Connecticut, who was carrying on, at that time, a large fish and stock farm at Mystic Bridge. It is undoubtedly true that the chief motive for issuing the call was, as the call plainly states, a desire to do something for the protection of the interests of fish culturists. It is also true that from the very first moment of the assembling of the meeting, as will be seen later on, the mere pecuniary interests of fish culturists became a secondary consideration. It should be stated here, by way of explanation, that the term "fish culturist," at that time, meant trout breeder, for there were then no practical fish culturists in this country except the trout breeders, and it may also be added that trout breeding meant the raising of the brook trout, or speckled trout, of New England and New York, now, I think, generally known all over the world by its Latin cognomen, fontinalis.

The call was accordingly addressed particularly to those engaged in the raising of trout.

It is true that the State of New Hampshire had created a Fish Commission six years before, and the example had been followed by several other States. The Fish Commission of Massachusetts had already contributed to the world, through its reports, some of the most valuable information ever published on the subject of fish culture. Seth Green had already done successful work in hatching shad, the writer had built and operated a large salmon hatchery in New Brunswick, various States had experimented successfully on narrow lines in propagating other fish than trout, but the extensive and varied work of the United States Fish Commission, created a year later, had not been begun, and hatching work in this country on all other fish than brook trout (S. fontinalis) had, up to that time, been experimental rather than practical, so that fish culture not only meant trout culture, but trout culture meant the breeding of the fontinalis, or brook trout.

It was to brook trout breeders, therefore, that the above-mentioned call was issued, and the object of the call was to form an association for the protection of their commercial interests. But upon the assembling of the meeting, it became apparent at once that something altogether broader and less personal was in the minds of those present, and I think I can truly say that that which I may perhaps term the selfish feature of the call scarcely ever showed itself at all in the meeting. From the very beginning of the meeting, the little group of men assembled, appeared to be actuated more by an earnest and generous interest in the cause of fish culture than by a desire to promote private ends. The spirit that prevailed seems to me to have been that which has characterized the meetings of the Association ever since. It was comprehensive rather than narrow, devoted rather than self-seeking, and good-will to all prevailed over sordid feelings of competition with each other. If I remember rightly, hardly a word was said about regulating the prices of fish culturists' products or increasing the pecuniary profits of the business. Not a resolution bearing upon the pecuniary side of the subject was passed. It seems as if this handful of pioneers had a foresight of greater and better things. At all events, if the pecuniary considerations had anything to do with prompting the call of the meeting, they had no place in the meeting itself. The meeting having come to order, and a temporary Chairman and Secretary having been chosen, it was voted at once and unanimously to form a permanent organization, and Dr. Edmunds and the writer were appointed a Committee to draft a Constitution. Each member of the Committee presented a separate form for a Constitution, the one offered by the writer being the one finally adopted.

As the records of the early meetings of the Society have been lost, it may not be out of place to present here the original Constitution, as it was adopted at the time of the organization of the Society.

It is as follows:

CONSTITUTION.

ARTICLE I.—Name and Objects.

The name of this Society shall be "The American Fish Culturists' Association." Its objects shall be to promote the cause of fish culture; to gather and diffuse information bearing upon its practical success; the interchange of friendly feeling and intercourse among the members of the Association; the uniting and encouraging of the individual interests of fish culturists.

ARTICLE II.—Members.

All fish culturists shall, upon a two-thirds vote of the Society and a payment of three dollars, be considered members of the Association, after signing the Constitution.

The Commissioners of the various States shall be honorary members of the Association, ex-officio.

ARTICLE III.—Officers.

The officers of the Association shall be a President, a Secretary and a Treasurer, and shall be elected annually by a majority vote.

Vacancies occurring during the year may be filled by the President.

ARTICLE IV.—Meetings.

The regular meetings of the Association shall be held once a year, the time and place being decided upon at the previous meeting.

ARTICLE V.—Changing the Constitution.

The Constitution of the Society may be amended, altered or repealed by a two-thirds vote of the members present at any regular meeting.

(Finis.)

It is rather interesting to note how few changes have been introduced into the original Constitution during the twenty-eight years of the Society's existence.

It is also sad to note how few of those who took part in the organization of the Association have lived to see its growth. There is no one now living, I think, except Dr. Edmunds, then Fish Commissioner of Vermont, and the writer, who were present at this first meeting, or who took an active part in the organization of the Society.

A report of the meeting of organization that appeared in the New York Citizen, which, by the way, was the paper of Hon.

Robt. B. Roosevelt, who afterwards became such an ardent and influential supporter of the Association, read as follows:

"The Constitution having been adopted, the following officers were chosen for the ensuing year: W. Clift, Mystic Bridge, Ct., President; Livingston Stone, Charlestown, N. H., Secretary; B. F. Bowles, Springfield, Mass., Treasurer.

"It was then moved that an effort be made to secure an exhibition of live fish at the next meeting, and that the following gentlemen be requested to prepare papers, to be read at the next meeting, on the subjects annexed to their names:

"A. S. Collins—On 'Spawning Races and the Impregnation of Eggs.'

"J. H. Slack—On 'The Culture of Black Bass.'

"W. Clift—On 'The Culture of Shad.'

"Dr. Edmunds—On 'The Introduction of Salmon into American Rivers.'

"B. F. Bowles—On 'Land-Locked Salmon.'

"Dr. Huntington—On 'Fish in the North Woods of New York.'

"Livingston Stone—On 'The Culture of Trout.'

"It was decided to hold the next meeting and exhibition in connection with the New York Poultry Show, next year. It was voted to send a report of the meeting for publication to the New York Citizen and Round Table, the New York Tribune, the Springfield Republican, the New York Poultry Bulletin, and other papers at discretion; and the Secretary was instructed to mail the published reports to fish culturists generally."

Following is an account of the first annual meeting of the Association, taken from a New York paper of February 8, 1872:

"At the afternoon session yesterday the following officers were elected for the ensuing year: President, Wm. Clift; Treasurer, B. F. Bowles; Secretary, Livingston Stone; Executive Committee, Seth Green, J. D. Bridgman and A. C. Rupe.

"A paper was read by A. S. Collins on spawning races and impregnation of eggs; a paper by W. Clift on the culture of shad, and a paper by Dr. Edmunds on the introduction of salmon into American rivers.

"A box of a hundred trout eggs that Mr. Stone had taken by the Russian or dry method were examined, and 97 per cent. were found to be impregnated. The interest of the meeting was very much increased by remarks interspersed during the intervals by Seth Green.

"At the evening session B. F. Bowles read a paper on 'Trout in the North Woods,' and L. Stone read a paper on 'Trout Culture.' Discussion ensued on the dry method of impregnation, and the expression of those who had used the method was in its favor. G. S. Page moved that a memorial be presented to Congress for a more general distribution of ova throughout the country, and the motion was carried.

"Interesting remarks were made by Hon. Horatio Seymour on fish culture. . . . . He suggested that an effort be made to learn more in regard to fish culture in China and Japan, and also to obtain desirable varieties of the fish of those countries and introduce them into the United States. In pursuance of the suggestions, Messrs. G. S. Page and the President, Mr. Clift, were appointed a committee to communicate with various foreign countries and take measures for an interchange of fish with those countries.

"Gov. Seymour and Livingston Stone were appointed a committee to take charge of the publication of the proceedings of the Association.

"To-day's proceedings.—The Association met at 10 o'clock this morning (February 8, 1872), President Clift in the chair. Some routine business was transacted, when the following resolutions were offered:

"1. To petition the Government to establish two or more fish hatching establishments—on Puget's Sound and the Atlantic Coast.

"2. To seek foreign exchanges.

"3. For a permanent fish exhibition in Central Park.

"4. That the headquarters of the Association be at No. 10 Warren street, New York, where the next meeting, in February, 1873, will be held.

"5. Recommendations to all States to encourage fish culture.

"Messrs. Dr. Streeter, of New York; S. Wilmont, of Canada, and S. F. Band, of Washington, were made honorary members.

"After miscellaneous business, the Association adjourned."

Permit me to close this somewhat lengthy paper with some extracts from the report of my own work as Secretary, during the first year of the existence of the Association:

CIRCULATION OF LAST YEAR'S REPORT.

"In order that the meeting of practical fish culturists in New York, December 20, 1870, the first in the way of organization, in this country, might be generally known, a copy of the report of the meeting was sent to all the leading newspapers in New England and New York, and to some farther West and South, and also to nearly 200 practical fish culturists in various parts of the country.

"I am happy to say that the newspapers in almost every instance printed the report in full or noticed it in some way.

"THE AGASSIZ CIRCULARS.

"For some time previous to the meeting on organization I had held a correspondence with Professor Agassiz on topics relating to fish culture, in the course of which the Professor mentioned a labor in which he is now engaged, of preparing an illustrated work of all the salmonidae of this continent, showing the variations of age, sex, locality, and the like; and after the formation of the Association he suggested that the Association should use its influence in furnishing material for this work. . . .

"I consequently take the liberty here to remind you that this is a most valuable work which Professor Agassiz is undertaking, and one which will be unsurpassed by anything of its kind in the world, and I warmly commend it to the attention and interest of the members of the Association.

"Mr. Agassiz cannot finish his work unless the requisite material is furnished him, and the members of this Society and all interested cannot do the distinguished naturalist a greater kindness, nor the cause of fish culture a better service, than by sending him, as opportunity permits, specimens of the various individuals of the salmon family. . .

"THE ST. LAWRENCE RIVER CORRESPONDENCE.

"During the session of the High Joint Commission at Washington last spring, I received a letter from Hon. Stephen H. Ainsworth, asking me, as Secretary of the Association, to request our State Congressional delegation to use their influence with the Commissioners to adopt some measure towards removing the obstructions in the River St. Lawrence, which prevent the salmon from ascending its tributaries. I accordingly wrote to our New Hampshire Senators and Representatives on the subject." Of the correspondence which resulted, I will merely offer here one letter, and this chiefly because the name of the distinguished writer has been recently brought to the country's attention by the death of his son and namesake in the famous charge of the heroic Rough Riders in Cuba:

Department of State,
Washington, April 20, 1871.

Hon. E. A. Hibbard, House of Representatives:

Sir—In answer to your note referring to a communication from Mr. Stone on the subject of salmon fisheries in the tributaries of the St. Lawrence, I have the honor to say that Mr. Stone's letter was one of many interesting communications on the same subject.

As the obstacles to the free access of the salmon to these rivers are matters within the control of local or provincial legislatures of the British colonies, I have brought the subject and laid several of the letters informally before Sir John Macdonald, from whom, I understand, that the obstructions complained of are prohibited by the Canadian laws, and that the authorities are constant in their efforts to prevent them from being placed in the river, and patrol the river for that purpose, but find it very difficult to prevent the violation of the laws on the subject. He has taken the letters, and assures me that no efforts will be wanting to prevent or punish future violations.

Very respectfully yours,
HAMILTON FISH.

"NEW MEMBERS.

"In the course of the year I took occasion to write to most of the practical fish culturists of this country, whose acquaintance I had made by correspondence or otherwise, to the number of about 200, extending to them an invitation to join the Association. These letters met with various replies, some few were not answered at all, but they were, on the whole, well received, and the replies in most cases contained expressions of interest in the prosperity of the Association.

"The notification circular of the present meeting was sent to all professional and amateur fish culturists whose names were in my possession, and to the Fisheries Commissioners of the various States, and was generally noticed in the newspapers and agricultural periodicals.

"In conclusion, I will merely add that in the course of the year I have mailed 500 letters on business of the Association, and nearly 1,000 circulars and papers.

"LIVINGSTON STONE,
"Secretary A. F. C. A.

"Albany, February 7, 1872."

The next annual meeting of the Association was held about a year later, but the Association was no longer in its infancy. It was now on a firm foundation, and has since contined to grow in strength and favor.

Mr. Whitaker: I move you, Mr. President, as a recognition of this distinguished man's work in this connection, that a vote of thanks be given Mr. Stone for his able paper.

The motion was duly seconded and unanimously carried.

Mr. Clark: You will notice in Mr. Stone's paper that the Society was called The American Fish Culturists' Association, and at the proper time I wish to take up that matter of a change of name. I think the present name of this Society is inappropriate, "The American Fisheries Society." That does not show what this Society is. It merely shows that we are fishermen. The name of the Society should be changed back to the "American Fish Culturists' Association." It carries more of the idea of fish culture with it.

Mr. Whitaker: You will remember Mr. Mather referred to this same subject two years ago and said the reason the name was changed was that the scope indicated by the old title was too narrow.

Mr. Clark: Away back ten years ago, when I think Mr. Whitaker was Secretary of the Michigan Fish Commission, this same question came up. I think the name certainly ought to be changed in some way.

Mr. Barrett, of North Dakota, was then introduced to the delegates by President May, who stated that Mr. Barrett would say a few words on the subject of "Fish Culture in North Dakota."

Mr. Barrett said: Mr. President and Gentlemen: Our State Legislature eight years ago created a Department of Irrigation, Forestry and Fish; the duties whereof have devolved upon myself from that time until this. I give my time and attention to forestry, at the same time fish culture received much of my attention.

I will say that we have no State fish hatchery. The fish are obtained from the United States Fish Commission. It is very difficult to obtain fish from that source for the simple reason that the demand throughout the United States for fish is far in excess of the supply the Government has, and yet North Dakota has received a fair amount of fish, for which we feel very thankful.

Some lakes received fish to the amount of 30,000. Last year I distributed a whole carload of fish.

In my annual report I pointed out the various ways to cultivate fish and how fish could be protected, etc., and I also presented various systems for doing it, and one of them is this, and I have advocated it for ten years. It is what I call the Home Fish Culture System; that is, raising fish on the farms, the water coming from our artesian wells, being lifted by means of wind power and other means from the springs on the farms, and from brooks and artesian wells.

I will say we have made pretty fair progress on some points. There are some men who have been raising fish in that way in an artificial manner on their farms for a number of years. Year before last I furnished one man some thousand brook trout for a little stream on his farm, the source of supply coming from a spring which he had dammed up. A good many artificial ponds are made in that way.

I have been experimenting in raising fish in water lifted into tanks by means of wind-mills, and we have made good progress in that direction. What has interested me most is my success in raising fish in artesian water. I have been advocating this system for ten years and whenever I have had an opportunity I have been experimenting. Last winter I devoted some months to experimenting with fish in artesian water, and I am pleased to say that I met with excellent success. I don't say that my success proves that fish can be raised successfully in artesian water; I want to experiment further. Thus far it has been very encouraging. I know in South Dakota a large number of fish are raised in artesian water, the German carp especially. The fish we experimented with are yellow perch and some other fish, and there were no failures. I desire to say, in conclusion, that this idea can be worked out. It may be made practical in different parts of the West. In North Dakota we have 700 flowing artesian wells. If we could have the fish raised on the farms it would be of great advantage to our farmers and a source of some income.

That you may be somewhat impressed with this fact that fish can be raised in artesian water, and good fish, too; fish that are desirable for food, I will show you some of the fish I experimented with last year. (Mr. Barrett here exhibited specimens of preserved fish.)

Mr. Clark: I move that we now take a recess until to-morrow morning at 9 o'clock.

The motion was duly seconded and carried, and a recess was taken until Thursday, July 22d, 1898, at 9 a. m.

THURSDAY MORNING SESSION.

JULY 21, 1898, 9 A. M.

President May: The meeting will please come to order. I think we had better have read the reports of such committees as are ready to report.

Mr. Whitaker: I think that the Committee on Time and Place of Meeting had better report first. The committee has no written report, but submits the following report:

Your Committee on the selection of time and place for the next meeting of this Society, begs leave to submit the following report. We met and considered the various propositions made to the Society for the next place of meeting. We had invitations from Milwaukee, Philadelphia and Niagara Falls. Taking the whole matter into consideration, the central location of the place and the fact that we have already met in the West two years in succession, it seems to us that it is best to go East, to some central point. Your Committee, therefore, respectfully submits Niagara Falls as the place of the next meeting. After consulting with Prof. Birge yesterday and this morning he suggests it would perhaps more nearly meet the convenience of the men of the colleges who are engaged in biological work and the college examinations, if the fourth week in June were selected. I know the field work on the lakes on which the United States Commissioners have entered will begin hereafter, in all probability, on the first of July, and that would tie up some of these men after that time. We, therefore, recommend Niagara Falls as the place of meeting, and the 28th and 29th of June, 1899, as the time.

President May: You have heard the report of the Committee, what is your pleasure?

Mr. Gunckel: I move that the question be divided and a vote be first taken on the location.

Mr. Peabody: I would like to present the claims of Milwaukee and of Wisconsin very strongly. The climate, situation on the lake and the interest in fish culture taken by the people of Wisconsin and all that sort of thing, we think makes Wisconsin and the city of Milwaukee the most desirable point to meet. The city of Milwaukee has extended you a very cordial invitation, as have the State Fish Commissioners.

Mr. Spencley: If it is thought best to have the Society meet at Niagara Falls, I would like to have it recommended that we meet at Milwaukee the succeeding year.

Mr. Whitaker: I believe it is not within the province of this Society to select a meeting place for the year following next year. Of course we all appreciate the fact that Milwaukee would be a delightful place to meet and we would receive entertainment there that we might not receive at Niagara Falls, but the thing that appealed to the Committee was, that we have now met two years in the West and should get nearer the bulk of our membership another year. We don't want them to think that we have taken this Society to the West and propose to keep it here. We should meet further East next year.

Mr. Spencley: While I support Mr. Peabody's remarks as to his recommendation concerning Milwaukee, I am willing that some other place be selected, because I think in 1900 Wisconsin will be in a better position to entertain the Society than they are now. In other words, the new trout hatchery will be in better shape. I therefore will acquiesce in the report of the Committee.

Secretary Whitaker: I move the adoption of the report.

Mr. Clark: I heartily agree with the report of the Committee on the place of meeting. Am I to understand that this question is to be determined now?

President May: Yes.

Mr. Clark: Just the location?

President May: Yes.

Mr. Dale: I have an invitation from the Pennsylvania Fish Commission for the Society to meet in Philadelphia. I yielded to Omaha last year, but I think it would be more advantageous, as Mr. Whitaker said, to go to a more central point than Philadelphia.

President May: It has been moved and seconded that the report of Committee on Time and Place of next meeting of this Society, fixing the place at Niagara Falls, be adopted; are you ready for the question?

The question was put and unanimously carried, and Niagara Falls was selected as the place for the next annual meeting of the Society.

President May: Now as to the other part of the report, as to the date, the Committee have recommended the 28th and 29th of June, 1899.

Mr. Clark: I really hate to rise on this point, because last year I had so much to say about the time of the meeting. Last year it was put off really on account of many of the United States Fish Commission men. I would prefer to have it come at another time, but I suppose perhaps Prof. Birge and the other University men would not find another date convenient.

Prof. Birge: I think the Society ought to vote to accomodate the greatest number. It is obvious, as the colleges do not close until the fourth week of June, that the college men could not attend on a later date, at the same time we have but two present at this meeting, and I don't know that it is worth while to put the Society to an inconvenience on their account. I have enjoyed this meeting and I should expect to attend the Niagara Falls meeting if possible, but at an earlier date it would be entirely impossible.

Mr. Nevin stated that he favored July 12th.

Mr. Whitaker: It is a matter of indifference to me personally, but we ought to fix the time of meeting so that we can get the largest attendance. The suggestion made as to the date, I think, arose out of some conversation I had yesterday with Prof. Birge. We all know that the interest of the meeting a year ago at Detroit, without being invidious, was very largely contributed to by the gentlemen from the Universities, and it is very desirable, if possible, to have them present next year. I had some conversation with Prof. Birge with a view of accommodating ourselves to the convenience of these gentlemen. He told me the third week in June would be examination week, he thought, and from what he said I thought probably the fourth week in June would be as convenient as any; that was the idea on which the Committee made its report.

Mr. Clark: Of course the United States Fish Commissioners don't want to do anything at all that is going to interfere with the work of Prof. Reighard; but that work is to be carried on not only during the summer but is to be continued continuously, probably next year if the appropriations are large enough to permit it. I certainly don't want to say anything further. I think, take it all in all, it would be as well to have it on the 28th of June.

Mr. Stranahan: With reference to this matter of the professors and biological work. Suppose the work was interfered with in July, they would only have to lose a half a day, aside from the time that they devote to the convention. It would be a pleasant trip for them, and there is no doubt they would like a little rest after a couple of weeks' work. I don't believe it will interfere with one of these men that are at Put-in-Bay.

Prof. Birge: That is my feeling. I move that it is the sense of this meeting that the date of the next meeting be fixed for the 12th of July. I offer this as an amendment to the report of the committtee as to the time of meeting.

President May: The question is on the amendment, placing the date July 12th.

The motion was then put by the president, who said: I am in doubt as to whether the motion carried or not. I will ask for a rising vote.

A rising vote was taken, which resulted in four members voting for the amendment and six members voting against the same, and the amendment was lost.

President May: The vote now will be on the date named by the committee, which is the 28th and 29th of June, 1899.

The motion was seconded and carried.

Mr. Gunckel then read the report of the committee on nominations and moved the adoption of the same.

The motion was duly seconded and unanimously carried, and the following gentlemen were named as officers for the next year:

President—George F. Peabody, Wisconsin.
Vice-President—William H. Bowman, New York.
Recording Secretary—Herschel Whitaker, Michigan.
Corresponding Secretary—J. E. Gunckel, Ohio.
Treasurer—L. D. Huntington, New York.

Executive Committee—J. A. Dale, Pennsylvania; E. E. Bryant, Wisconsin; J. J. Stranahan, Ohio; F. N. Clark, Michigan; J. W Titcomb, Vermont; W. L. May, Nebraska; Dr. J. A. Henshall, Montana.

Secretary: I understand the next paper in order is the paper of Prof. Birge on the Relation between the Areas of Inland Lakes and the Temperature of the Water.

Prof. Birge: Mr. Clark is anxious to hear the paper by Prof. Bumpus, and if there is no objection I will read it first.

Consent was given.

Prof. Birge then read a paper prepared by Dr. H. C. Bumpus, entitled "The Identification of Adult Fish that have been Artificially Hatched," which follows.

THE IDENTIFICATION OF ADULT FISH THAT HAVE BEEN ARTIFICIALLY HATCHED.

Although the planting of artificially hatched fish in the inland waters may, and often does, yield immediate and undoubted increase, the results of fish culture along the coast are often much less definite, and conclusions are too often based upon the mere opinions of observant, but unscientific, fishermen. The recent excessive abundance of cod along the shores of New England, is probably the result of the extensive operations at the Woods Hole Hatchery. The facts that these fish were small when they first appeared, that they have since increased in size, that they have occurred in localities where cod had never before been caught, and that they are reported to be of a different color from the native variety, are interesting, although to the skeptical they are not absolutely convincing. There is need of some scheme whereby the adults of fish hatched artificially may be distinguished from those native to the locality.

To mark the fry is, of course, out of the question; but is it not possible that the fry mark themselves, i. e., is there not a slight difference between the fish of the same species, but of different, even though contiguous, localities? And if there is a slight difference, does it not present itself in a measurable manner? We all know that the bony rays, which support the dorsal fins, are subject to variation, both in respect to their length and their number. In fishes which have a large number of fin-rays, the variation is often considerably greater than those possessed of only a few. This variation is above or below a certain average or mean number, and the ampiitude of variation (that is, the amount of normal increase or decrease in the number) is definite for any given locality. During the latter part of March of the present year several hundred flatfish were examined at the station at Woods Hole with the purpose of determining the amount of variation in animals collected at different localities. The diagram marked "Woods Hole" is intended to illustrate the variation in the number of dorsal fin-rays presented by one hundred flatfish collected near the Laboratory. On this diagram each of the red marks represents a fish, and the marks are arranged in rows according to the number of fin-rays. Thus at the left of the diagram it will be noted that one fish had only 62 dorsal fin-rays, seven fishes had 63 fin-rays, twelve fishes had 64 fin-rays, twenty-two (the largest number of individuals) had 65, eighteen had 66, twenty-one had 67, and from there on the number of individuals almost constantly decrease, nine having 68, six having 69, one having but 70, one having 71, and two having 72. A curve, then, drawn through the culminating points of the several columns is a curve that represents, at least roughly, the variation in the number of dorsal fin-rays for this specific locality. The curve indicates that no matter how many flatfish may be collected at Woods Hole, specimens having less than 62 fin-rays will be extremely infrequent, while those having slightly more than 72 fin-rays may occasionally occur. The variation is about an average which lies near the column 66.

If we now tabulate the fin-rays of an equal number of flatfish from another locality, it is evident that if the fishes in both localities are alike, the curves will coincide. If, however, the fishes are different, even slightly so, the lack of coincidence in the curves will indicate the difference.

The diagram marked "Waquoit" is based on the variation in the number of the dorsal fin-rays of one hundred flatfish taken at Waquoit, from a small bay only eight miles east of Woods Hole. Compared with the first curve, the Waquoit curve lies further to the left, has a shorter base and a less altitude. The Waquoit collection contains fifteen fishes which have a less number of fin-rays than any fish collected at Woods Hole, a striking difference when one considers the small number of fish examined. Moreover, the right side of the Waquoit curve is almost equally characteristic, and the average number of fin-rays in the Waquoit fish is very evidently less than the average number at Woods Hole. The Waquoit fish are more variable, the ampliture at Woods Hole being 62 to 72 (11 points), while the ampliture at Waquoit is from 60 to 71 (12 points).

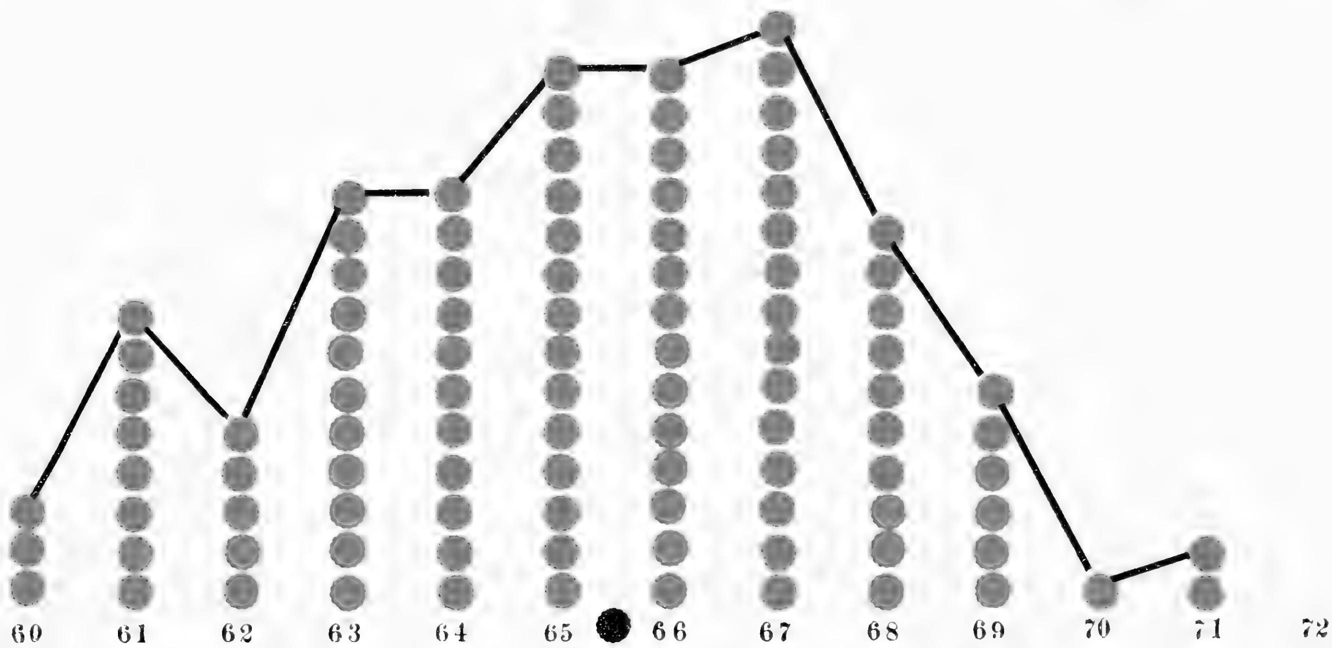
These curves of distribution bring out certain characters that it would be quite impracticable for one to detect by the mere examination of a few representative fish, and it would be quite possible for one to decide by such curves which of two baskets of fish come from Woods Hole and which from Waquoit, even though the fish bore no other mark than that provided by nature.

The practical application of this principle is as follows: If it proposed to test the result of re-stocking a locality in which a species of fish has become reduced in numbers, it is necessary to first determine the "curve of distribution" from fish native to the locality. This curve may be based on any measurable character, such as the number of fin-rays, the number of scale-rows, or the number of vertabrae. When this has been done, it is then necessary to determine the "curve of distribution" for the same structural character of fishes of the same species, but abundantly found in another locality, from which locality the "brood fish" are to be taken. After the "planted fish" have had time to mature, new curves should be plotted for the first locality. If these curves are practically the same as those originally made, it is reasonnable to conclude that re-stocking has been ineffectual. If, however, the curve of the original locality becomes modified and approaches that of the second locality (that is, the locality from which the brood fish were taken), it is reasonable to conclude that the influence of the fish new to the locality has been felt, and that the re-stocking has been effectual.

The following objections may be raised to the method just given:

1. It may be that due to the small number of specimens, the curve represented on the first diagram is not really characteristic of the Woods Hole specimens.—To test this source of possible error, three separate groups of flatfish were examined, all from the same locality, and each group containing one hundred speciments. The resulting curves were strikingly alike. (Of course it would be much more satisfactory to base all the curves on the enumeration of one thousand rather than one hundred specimens, but even one hundred specimens evidently yield fairly definite results, though, to be sure, the curves are somewhat uneven.)

2. It may be that the variation in the position of the curves on the two diagrams is a result of age—i. e., the fishes from Woods Hole average a larger number of fin-rays simply because they are somewhat older. This possible increase on the part of the older specimens, if present, can readily be detected by simply comparing the average number of fin-rays of the younger with the average number of fin-rays of the older fish. Fifty-three young, *less* than ten inches in length, have a mathematical average of 66 dorsal fin-rays; forty-seven older fishes from the same locality, all *over* ten inches in length, average



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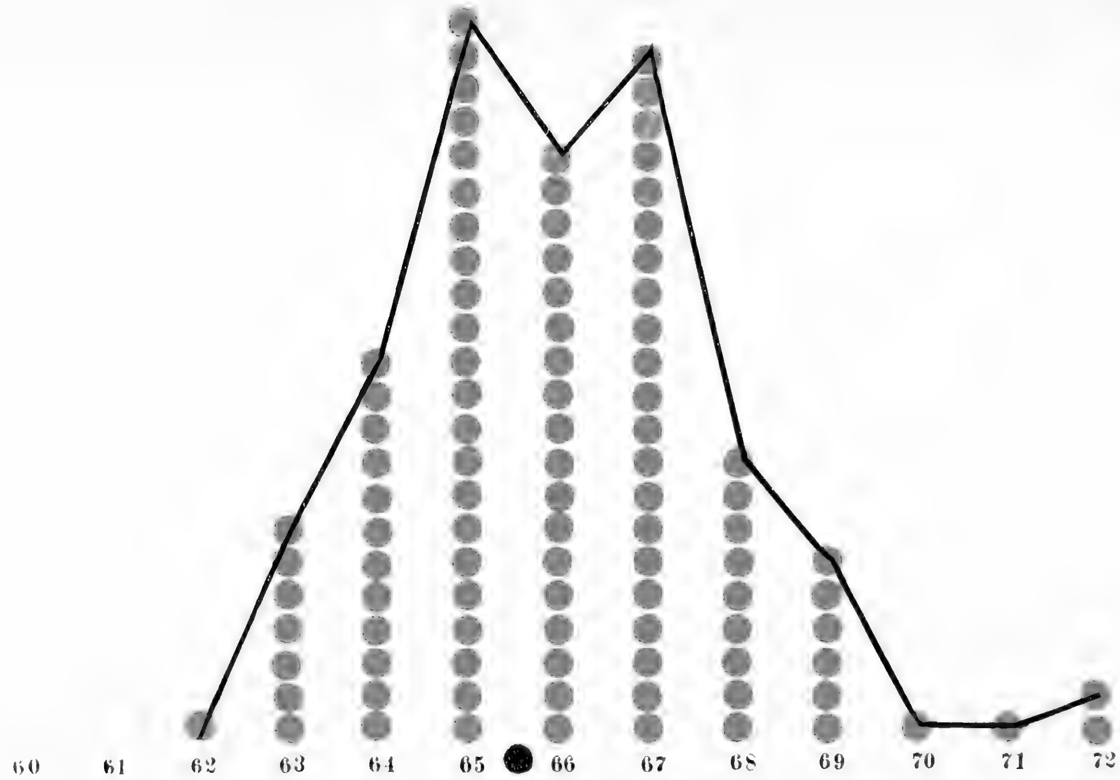


WOODS HOLE.

practically the same number. The question of age, then, does not enter in as a disturbing element.

3. It may be that the variations tabulated are the result of environmental conditions expressed upon the fry and young; they may be merely acquired characters of questionable hereditary value. In other words, it may be that the fry reared at Woods Hole attain to a larger number of fin-rays than the same fry would possess were they reared at Waquoit. While certain experiments that the writer has made induce him to believe that these variations in the number of dorsal fin-rays are really deep-seated characters and are *not* the result of environmental conditions, it must be remembered that if the variations are admitted to be the result of strange surroundings, the method is not necessarily thereby vitiated, for if it is insisted that certain external influences may affect the fry *after* liberation from the hatchery, and the results of these influences are expressed by a change in the fin-ray formula, it must also be equally true that the much more extreme an unusual environmental conditions imposed upon the still younger organism while *within* the hatchery will also leave their stamp, and the artificially hatched fish will thus present some peculiarity (acquired though it may be) which will be brought out by the plotting of curves of distribution.

Mr. Whitaker: What is your opinion, Prof. Birge, as to these structural differences spoken of and the ideas advanced in this paper upon that point?

Prof. Birge: It seems to me there is a chance for very valuable work just in this connection. The flatfish hav an enormous number of fin rays, so great a number that we should naturally expect the kind of local variation which the professor finds. Whether this would be true of the whitefish or lake trout or any of the fish of the Great Lakes, I dont' know, but it seems to me that there is a point the fish culturists might well investigate. I haven't very much doubt that somewhere or other there could be found some such difference between the Lake Michigan lake trout and the Lake Superior lake trout. If, as Mr. Nevin says, we have to go to raising Lake Michigan trout eggs and planting them in Lake Superior, it would be quite possible to determine whether the fish as they are caught were the result of planting or the result of natural increase.

It is almost always true with any species of animals from different localities, certainly when they are widely separated, that though when you take two or three of them and look at them you may not discover any particular difference, yet if you take enough of them from various localities the characteristics will come out in the average.

Mr. Whitaker: I have never given any attention to those differences, but I had supposed from my familiarity with fish and from reading Dr. Henshall's Book on the Black Bass, that one of the distinguishing differences between the large and small-mouthed bass was the number of fin rays in the dorsal fins, and the number of fin rays in the dorsal was of a constant character and that the number of rays was always the same in each individual.

Prof. Birge: The number of fin rays is characteristic for any species of fish, but the number is not absolutely constant. The spinous dorsal fin rays in the black bass are, I believe, 11 or 12. Where the number is so small you would expect to find little variation, although it might be possible that in the black bass from one locality you would find a larger proportion with, say 11 rays, than you would in those from another lake. If that should be found, it would be an instance of the same sort of variation that Prof. Bumpus finds in flatfish.

Mr. Clark: I would like to ask the professor why there should be this difference, why Dr. Bumpus should probably come to this conclusion that these were artificially hatched eggs.

Prof. Birge: He does not come to that conclusion.

Mr. Clark: In a sense he infers it.

Prof. Birge: No, you don't quite get his idea. Prof. Bumpus has simply taken these fish from two different localities as an illustration of what might be done to determine whether given fish are the result of planting or of natural increase. The point is this: Suppose that you breed from the fish at Wood's Hole and plant the young along the coast. Later you study the number of fin rays in the flatfish from the places where you have planted the fry. The average number of fin rays would show you whether the fish were the natural product of the locality or the result of planting.

Mr. Stranahan: I would like to add as to the general subject as to the shape of fishes that we have in northern Ohio two distinct forms of small-mouth black bass, I perhaps might say varieties, although our more scientific friends might consider even "varieties" too strong a word.

The ones in the rivers above the dams are longer, slimmer and more fusiform: those in the lake, which never enter the rivers, are shorter, broader, and more compressed.

There is also an intermediate between the two, partaking of the characteristics of both. These come from the lake into the mouths of the rivers and up to the first dam to feed and to spawn in the spring and to feed in the fall, and it is not improbable that they also hibernate there, as I have caught them there late in the fall on a warm day, after hard freezing weather had set in.

The pike-perch of Sandusky Bay is easily distinguished from its species taken about the islands in the main lake, being more fusiform and longer for a given weight besides being of a decided yellow cast, while the lake fish is broader, more compressed and the yellow shades almost or quite wanting. It may be interesting to state, in passing, that the pike-perch taken in the Lake of the Woods in Canada—many of which are brought to Sandusky to be marketed—cannot be told from those taken in Sandusky Bay by the commercial fishermen who are handling them constantly.

These differences are persistent to a well nigh universal degree, and perhaps might be worked out in the more minute structural lines as to fin rays, scales, etc.

Prof. Birge: Yes, they could be; the question would at once arise whether these differences are sufficiently permanent. For instance, you brought stream black bass into a lake, will they keep the stream form or assume the lake form?

Mr. Stranahan: You may stock a stream ever so well with black bass from Lake Erie and if they can possibly get back to the lake, they will get there. We know that by experience; the ones planted from Sandusky Bay planted in Chagrin river didn't show up at all. I should expect to see that hereditary disposition show up for one or two generations.

Prof. Birge: How is it about stocking lakes with stream fish?

Mr. Stranahan: They would go to the streams if they could get there; their hereditary disposition doubtless would carry them into the streams.

Prof. Birge: The professor has used for practical purposes, one of the newer methods in biology. One thing that biologists have been doing recently has been to get at the average of structure and to state the amount of variation from the average. They have begun to measure in a large number of individuals the main structural characteristics, which are capable of measurement, so that they can tell in a moment what the average is and how the animals distribute themselves within the range of variation. There is often a great difference in this distribution, so that while the average may be very nearly the same, and the amount of variation may be very nearly the same, the curves may be very different as in some of these diagrams. It seems to me that there is a point of very great practical value. I don't think very much of your matters of general form in connection with black bass and the shape of black bass. I think that would be too variable and too indefinite.

Mr. Clark: It is a fact that in the Great Lakes we can pick out fish that we are almost positive were artificially hatched, from the looks of the fish. Now, for instance, and I think the superintendents here will bear me out, we find in upper Lake Michigan and Lake Superior, fish that we at once say, is a Lake Erie whitefish.

Mr. Whitaker: There is no doubt about it and it has just the appearance of the Lake Erie whitefish as to its form, and general color. We, of course, as practical fish culturists, have not entered into this question of structural differences that you speak of. We distinguish the difference by the form and color of the fish.

Mr. Nevin: It is the same thing between the Lake Michigan and Lake Superior fish.

Mr. Whitaker: The work of the Michigan Fish Commissioners is a pretty fair practical test in the determination of that question. Our commission gets its supply of ova largely from Lake Erie whitefish. These fish are distributed by us all through the other lakes, and we frequently receive reports from fishermen which show there is a variation in form and color between the planted and indigenous whitefish which distinguishes them. They say "these are Lake Erie whitefish because they are different from ours;" that is, the difference is so marked as to be noticeable.

Mr. Nevin: In 1889 we planted about 10,000,000 whitefish in Lake Superior; in the last three years they have been getting them by tons and tons. Fishermen will go out and catch them in great quantities.

Mr. Stranahan: Mr. J. N. Dewey tells me that he catches fish at West Sister Island that are very different from the Lake

Erie fish. He says they are so different and distinct that the fishermen can readily pick them out. Fry of the black fin whitefish were planted there some ten years ago.

Prof. Birge: The counting of the number of fin rays is no very enormous job.

Mr. Stranahan: Don't they have to dissect them?

Prof. Birge: No, simply spread out the fins and count the rays.

Mr. Bower: It seems to me that this discussion has developed the fact that we have too little faith in the fish we turn out from hatcheries. When young fish are returned to indigenous waters I challenge anybody to give a reason why there should not be as good results as from those hatched in the natural way. When we can take shad from hatcheries, transport them across the continent, and plant them into waters where the species had never existed, then contemplate the remarkable results that have followed, our faith in the work of planting fry rests on the solid foundation of proof of results. We didn't need to identify the first adult shad that appeared in the bays and rivers of the Pacific coast, nor was it necessary to identify one trout in hundreds of streams in Michigan. The simple presence of these fish was proof indisputable that they grew from planted fry. Should not our faith in the work of planting fry in strictly native waters be strengthened rather than weakened, in the face of what planting in non-native waters has accomplished? And should we not feel entirely confident that as large a percentage of fry so planted survive to maturity as from the wild fry, whether we shall ever be able to identify one from the other or not?

Mr. Whitaker: The point made by Mr. Bower has been proven repeatedly. I don't think you need to argue to fish culturists that artificial propagation has not been a striking success in the stocking of waters. The great success that fish culturists gain by their methods is gained by the isolation of the ova from natural enemies until the eggs have hatched. Up to that point you have minimized the loss. We have in Michigan the finest river in the world for brook trout fishing and that stream was first stocked with trout in 1879. I intended to have brought some data I have as to the immense number of trout taken from it in one year, given me by Salling, Hansen & Co., of Grayling, Mich. They arranged with the boatmen on that stream to give them an estimate of the number of fish taken on the stream, during the season. I cannot state the number because I don't remember, but it was perfectly marvelous. The river contained nothing but grayling up to 1879, when our commission began stocking it with trout, and the results of that work establish beyond doubt the efficacy of artificial propagation. I wish to endorse what Mr. Bower said regarding the stocking of Pacific slope streams with shad and its success. There is an interesting thing to fish commissioners in connection with that work. Col. McDonald took occasion at one time to write a monograph on that work which was very interesting. He stated that the Japan current sets in towards the coast of California, and because of the temperature of that stream instead of the shad only returning to the rivers where planted they have distributed themselves northward in tidal streams for hundreds of miles. They have stocked those waters so thoroughly, from the small plants made, that Mr. Blackford when in San Francisco a few years ago sent a dispatch to this society at a meeting held in New York, stating that the number of shad on the market in San Francisco was so great that they had to avoid glutting the market by regulating the catch, and that the shad were larger in size and greater in quantity and cheaper in price than in the New York market. It is the same with the striped bass and neither one of these fish were indigenous to the streams of the Pacific coast, but were the results of planting.

Mr. Clark: Perhaps the members of the society will think that after a life of thirty years in practical fish culture, I am losing faith in the work of the fish culturist, if I say nothing at this time. I want to put myself right and straight on the matter. I am just as strong in the faith as I ever was. Speaking of the work of transplanting shad from the Atlantic to the Pacific coast, I will say the United States Fish Commission made these plants—and I don't like to say that I was one of them, but I was. Outside one small plant, the plants of shad carried to the Pacific coast were carried there under my direction; that is, I had charge of the trips up to the time that the fish were sold in the San Francisco market for five cents apiece. I carried all the fish to the Sacramento River except five thousand; therefore, I ought not to lose faith in fish culture.

Mr. Whitaker: Do you remember about what the aggregate of the plants of shad was?

Mr. Clark: Six hundred and forty thousand made in three different plants, outside the plant made by Mr. Greene. In 1876 I took through, with Dr. Bean as my assistant, 200,000; in 1877 I took through 200,000, in 1878 I took through 200,000. If the gentlemen here had seen Dr. Bean and myself trying to take through the first 200,000 they would have thought we were lunatics. The report was that it was not possible to transport them in a baggage car in cans unless you could keep the temperature above 72. In going over the mountain in summer time in June, we found pretty cold weather in the night time. There were snow storms and we built a fire in the stove. We could not warm up the water; it kept going up and up and at last we took our coats off and rolled up our sleeves and ran our arms down into the water and tried to warm the water. We pulled off our shoes and stockings and put our legs in and tried to warm the water. It ran down and down, but we succeeded in carrying through to San Francisco a lot of the finest shad I ever saw.

Mr. Bower: I wouldn't have it understood for a moment that I belittle the kind of work spoken of by Prof. Bumpus, but what I do want to say is that I don't believe in the necessity and don't understand exactly why fish culturists should need to have documents of that kind to bolster up their faith in fish culture. We don't need to have our fish identified before we are satisfied that we are getting good results.

Prof. Birge: It seems to me that Mr. Bower has understood this paper differently from what Prof. Bumpus intended it should be understood. I don't understand that we are arguing that the work of planting fish is not practical, but there are a great many people, and gentlemen of intelligence, who say, how do you know when you put fish in Lake Erie, for instance, what becomes of them? How do you know they have come back again, that they don't go away, or how the fish increase, or that these are not the fish that came in from the natural breeding grounds? You can answer the question and perhaps prove it and no doubt you can, in many cases, convince the man you are talking to that you are increasing the fisheries in that manner, yet if you can have a definite and positve answer it would be better. The more positive proof you have, it seems to me, the better.

Mr. Spencley: It seems to me there is a great deal of difference between faith and proof. Mr. Bowers says he has a great deal of faith, that is all very true; I don't believe any person present at this meeting has any doubt about the success of fish culture, but as Prof. Birge has said, sometimes you have got to prove it.

We have had some difficulty in Wisconsin. We have been telling people that we have been planting whitefish and that they have been increasing in numbers; some of these people will say, I don't believe you, you haven't got anything to prove it. You cannot convince the average fisherman against his own will. Several years ago Mr. Nevin took inland fish and put them in Lake Superior; they produced an entirely different kind of fish, so that the fishermen then had to admit it. There was the proof and the fishermen of Lake Superior now admit that fish culture is a success. I think this paper is in that direction, it is to get proof so that it will satisfy everybody and will give them the proof that fish culture is a success. I think he has tried to demonstrate in another way that it can be shown by proof that the artificial propagation of fish is a success. It is simply in the same line as these experiments with the Wisconsin fish.

Mr. Whitaker: If there is no further discussion on this paper I beg the indulgence of the society for a few moments. We have with us a citizen of Omaha who is seeking information about fish. He is making some experiments which he desires to have a little advice upon. He proposes to do some work in fish culture in connection with artesian water. He is the Surveyor of Customs of this port. I have the pleasure of introducing to the society Dr. Geo. L. Miller, of Omaha.

Dr. Miller: Gentlemen: This is an agreeable surprise to me. I saw the notice of your coming among us and I took an immediate, personal and selfish interest in it as well as a public one. It is indeed a very great courtesy that my friend suggests that I should say a word in a convention of this importance, devoted to prepared papers and on fish culture.

I take advantage of the opportunity to say that I am, from my nativity and the associations of my boyhood, a lover of fish. Where this younger man (referring to Secretary Whitaker) first saw the sunlight and with the streams with which he was familiar, I have been familiar in a long and active life, the Northern Adirondacks. We were both natives of New York, you of Lewis and I of Oneida. I have resided here since this was a white settlement, for more than forty years. I came in here to hear suggestions from you on a subject in which I am interested. Mr. Ravenel, of the United States Fish Commission, has been very polite in making suggestions to me about a lake which I have of forty acres. I began without any scientific knowledge to put in breeders, and through the courtesy of Mr. May I put in some young trout and some old ones. I had hopes I could exclude all other fish, but to my utter astonishment the selections were not properly made, and I find I have all sorts of fish, peculiar and indigenous to the country. Mr. Ravenel told me that the rainbow would probably live in a temperature of 60, but for the reason that the water would become warm very soon after coming out of the artesian well, which is about a thousand feet away, I didn't venture to risk it. What I have come here to find out is, whether I could risk putting the rainbow in that water that is fed by water of 60 degrees temperature?

I would like to know if bass are cannibals. As I say, it is a purely selfish interest on my part, outside of a public one. I have raised bass from breeding to a pound and a half and a pound and three-quarters, and I have had two or three thousand fish taken out of there by fishermen.

I want to know another thing, if some gentleman will give me the information, whether bass are in any danger from bullheads and carp? I also want to know whether I am in danger of overstocking this forty acres of water which has neither inlet or outlet. I want to know what proportion I can expect to raise from breeding, and whether I am in danger of overstocking this place and making it an offensive place.

Mr. Peabody: We have a number of gentlemen who can give you a great deal of information. You will find out a great deal of that information from books written by Dr. Henshall.

Mr. Whitaker: I think the society is to be congratulated in having just such questions proposed. It touches the practical side of fish culture. I felt when I introduced the doctor, that the society would be very glad to hear from him. He has suggested enough to warrant us in giving him some information, if we can. I think there are those here who can give the information he asks for. I want to say that I had prepared a paper touching on this very point, but I find I have left it at home. It touched on the question of overstocking waters; it touched on the question of the proper places in which to plant fish; it touched on the question of the attempt to exterminate native species from lakes by netting. Very many people feel that they would like to know whether they can take a given water and stock it ad infinitum and make a success of it. I suppose it is a pretty well established fact that nature sets up a pretty correct natural balance between varieties of fish in all waters. Many of the states have beautiful lakes to which people resort for summer homes. Those lakes may have been naturally stocked with black bass, but the persistent fishing of a dozen or more anglers for four or five months in each year, with the spearing that goes on at other times, has in course of time depleted the waters of bass. The next thing that we as commissioners hear is an application from the denizens about some lake for a permit to net out the suckers, which they say have grown in numbers enormously, and they believe the suckers are killing the bass. This is not so. The bass is a fighter who will maintain himself against any other fish of even greater size. In no case should the attempt be made to destroy the sucker, which is prime food for the bass, or the carp, which is also fine food for the bass. If I had a private water in which I wanted to raise bass, I would see to it that a certain number of carp were put in there as food for the better fish, and they wouldn't hurt at all if you can keep them in control.

Again, we hear someone say, I have a magnificent stream, I want 50,000 or 150,000 brook trout put in that stream at its source. That is the poorest place that could be selected. Plant them away from the source; put them in ponds made along the stream. You there give opportunity to the insects to deposit their eggs, which are fish food. In time you have natural food that will to a great extent support fish life. You may overstock a stream or lake, and if you do so, in time you will have a generation of runts. You must avoid that. If you do it your fish will be undersized, and that is the case with many clubs who have overstocked their waters in their anxiety to increase their stock.

Dr. Miller: Would you leave the carp in the water?

Mr. Whitaker: You cannot get them out after they are once in.

Dr. Miller: Would you keep them reduced?

Mr. Whitaker: Yes, and I would reduce them by putting in enough bass to keep them down.

Dr. Miller: How about the bass eating one another?

Mr. Whitaker: The bass is supposed to be one of the very few fish that takes care of its young. They select a place for nesting and lay their eggs, and guard them from their enemies.

Dr. Miller: I think that Mr. Henshall states that after they leave their nests they eat each other.

Mr. Whitaker: Large fish will eat small ones under all circumstances if they get a chance. The fish culturist learns that in his practical work. You have got to separate fish of different ages as well as you can, to prevent it, when held in ponds.

Mr. Stranahan: The black bass won't prey on their kind if they have an abundance of other food. I believe it is of more importance to you, Dr. Miller, with your area of water, to see to crossing your fish with new stock than it is to look after the carp. I have had some experience with much larger ponds than yours where the stock has become diminutive through inbreeding. I should say it would be the best thing to introduce every year a new stock of bass; if you don't, you will get a diminutive race.

Mr. Peabody: There is a club in Indiana that has taken up the subject of producing bass artificially. They have two artificial ponds in which they keep their bass, and another in which they carry on the hatching. In the small one they keep the bass until they get large enough to be active; then the club takes all the larger ones and puts them out. They have a drain in the center of this pond by which they can draw the water all off. Then can go into it and take out all the fish. They have met with such success that they have their larger ponds amply stocked. They do this all in an artificial way.

Dr. Miller: I wish to state for the information of the gentlemen that Mr. May, the honorable president of your convention, is the gentleman who started me in my enterprise, with this result, that this year out of my lake there have been caught, I suppose, two or three thousand bass by hook and line. This spring I put in twenty breeders and I don't know how many young bass there are, but the lake seems to be alive with bass. I came here this morning without an invitation. I felt that I was somewhat at home with fish men. I came in to see about some things that have been answered by my friend from Michigan—originally from New York. I was told that I was in danger of overstocking this lake. I thank you, gentlemen, for your kindness. I can now go home with a good deal of light upon the subject I wanted to be enlightened upon.

President May: The next paper in order is a paper by Mr. O'Brien.

Mr. O'Brien then read the following paper:

LARGE-MOUTHED BLACK BASS.

Methods of Hatching and Rearing.

A great deal has been said and written, at former meetings of this society, on bass culture, by persons of much greater ability than myself, therefore do not expect an elaborate essay from me. But as we departed somewhat from the usual method of handling our bass spawners at the Nebraska hatcheries the past season, possibly my experiments and the results obtained will prove of interest to those engaged in this branch of fish culture.

Our main spawning pond has a surface area of about one acre and, with the exception of the kettle, or drainage point, averages about two feet in depth; bottom being both mud and sand.

Previous to the spring of 1896 it had been the custom to place the spawners in the pond as soon as the ice melted off, together with a large number of chubs and shiners to serve as food and pay no more attention to them until the pond was drawn off in the fall to remove whatever young bass there might be. This haphazard manner of propagation, of course, resulted in rather indifferent success.

In the spring of 1896 I used gravel spawning beds with brush shelter and removed a large number of the fry to another pond when about a month old and fed ground crayfish with considerable success.

The spawning season for bass, in our ponds, extends usually over a period of about six weeks and I noticed when we transferred the fry there was a great difference in the size of some as compared with others and after the fry was moved I noticed that although I fed an abundance of ground crayfish, and there was considerable insect life in the pond, the larger fry preyed on the smaller ones continually, diminishing the number to a considerable extent.

In the spring of 1897 I decided to change the method of handling the spawners entirely; instead of transferring them from the winter pond to the spawning pond when the ice melted off, we placed the spawners in a pond that had previously been used for trout where temperature was about 55 degrees.

We then drew off the water in the spawning pond about the 1st of May and allowed it to remain dry for ten days. We then placed eight wagonloads of mixed fine and coarse gravel on the bottom of shallow portions of the pond, in spots or beds about eight feet square and about two inches deep. We also put in twelve spawning boxes made of wood three feet square with sides three inches high and filled with gravel. The pond was then filled with water and willow brush laid in V-shape, the butt ends of the brush being crossed at the pointed end of the V, being placed around each spawning bed, forming a perfect enclosure.

Willow brush with the butt ends sharpened and stuck in the bottom of the pond was also placed around the spawning boxes to afford seclusion for the spawners.

May 29th the spawners, 42 in all, about an equal number of males and females, were transferred to the spawning pond; the temperature in the pond being about 66 degrees, a change of 11 degrees from the pond from which they were transferred; the spawners were put in near the inflow pipe and the change of temperature did not seem to affect them in the least, but as I had expected, it caused the ova to ripen rapidly and within twenty-four hours they began to pair and spawn, and in nine days from the time they were placed in the pond the last pair had spawned; out of the whole number only two pair used the spawning boxes and one pair spawned in open water on fine sand.

The eggs hatched out in eight days and when the fry were about a month old I transferred what I estimated at 20,000 to an adjoining pond, collecting them with a one-eighth inch mesh common sense minnow net, the most of them being taken about sundown around the inflow pipe.

In the same pond with the fry I placed a large number of eyed carp eggs, laid on moss, the carp when hatched to serve as food for the young bass. This experiment proved a failure, for within a month the carp had grown so rapidly that they were as large as the bass and were destroying all insect life and making the water very muddy.

Wooden boxes two feet square with slat sides one-half inch apart and supported by stakes driven in the bottom of the pond were then placed at different points in the pond and ground crayfish placed in these fed for the balance of the season, but the carp kept the water so roily that the bass did not seem to thrive and when the pond was drawn off in September less than fifteen per cent. of the number placed in the pond were found.

The original spawning pond was well stocked with chubs and shiners, which spawned about the same time as the bass. About the 1st of August I partitioned off about one-third of this pond near the inflow pipe with one-inch mesh galvanized wire fencing, supported by stakes driven in the bottom of the pond and extending ten inches above the surface of the water, this fence being put in to allow the young bass to feed on the minnow fry undisturbed by the parent bass. The bass in this pond thrived beyond my expectations and when the water was drawn off in October I removed over 33,000 young bass of an almost uniform length of three inches, not to exceed 30 oversized fish being found among the whole number.

The uniformity in size I attributed entirely to the fact that the fry were all hatched at practically the same time and I believe that if bass spawners were held in water of a low temperature until about the 1st of June and then placed in spawning ponds where the water is several degrees warmer, so as to ripen the ova rapidly and thereby shorten the spawning period, that much of the loss and annoyance caused by oversized fry would be avoided.

Although the experiment in feeding the carp fry to the young bass in the pond proved a failure, yet I am convinced it would be possible to keep carp spawners in water of a low temperature to prevent them from spawning until late in the season, allowing a few pair to spawn at intervals as needed; this, I believe, would prove a cheap and easy method of feeding bass fry in troughs or small ponds where the number of carp fed could be completely controlled by the attendants.

Mr. Stranahan: With reference to this matter, I will say that experiments have been made in France, also in this country by the United States Fish Commission in Washington, to retard the growth of carp. It has been found very successful. Mr. Ravenel told me that the results were very gratifying by withdrawing the food.

Mr. Clark: From Mr. O'Brien's paper I see that he is an advocate of the partial rearing of fish, and that brings us back to the old question that Mr. Whitaker, Mr. Mather and myself fought over so many years ago; the question of yearlings. I think, if I am not mistaken, they dubbed me the "Father of the Yearling." I will say I don't want to bring that question up now, but I am still an advocate of it, but not for bass. If the gentlemen that have been raising bass will take the pains to examine them minutely with the microscope they will find that a young bass one week old is as mature a fish as at five years old. For that reason I am an advocate of planting the fry of the bass. I think when it is thoroughly investigated it will be found better to plant the young bass. I want to put myself on record as an advocate of planting bass fry. If you plant them broadcast in lakes and rivers they can spread out more. It is a more difficult thing to find artificial food for young bass than for other fish.

Mr. Oberfelder: As far as the United States Commission is concerned, I presume it is all right to deliver fry, but when the people who pay for this work are sent the fry they don't think they are getting any fish. The Nebraska Fish Commission are trying to deliver pike six months old; I think the people throughout the State would be better satisfied with the delivery of such fish to them than the fry. They might not from the standpoint of the United States Commission. I know the commisisoner of Wyoming told me that they sent trout last year in cans, saying "there is 5,000 trout in a can," but those who received them said it was the same old fish story; we counted them and found there were but 850. After this they say we want more yearlings and no more fry.

Mr. Whitaker: I don't suppose there is any way by which you can guard against misrepresentation as to the number of fish that are put in cans. I think it is poor policy on the part of a board, and I think they will find that misrepresentations of that kind must ultimately come back to them injuriously. It is not policy, if you want to put in on the ground of policy. It is not honesty, if you put it on the ground of honesty.

So far as not getting results from the distribution of the fry is concerned, that may be as stated in the State of which the gentleman speaks, but it is not so in Michigan. The great and successful work of stocking there has come solely from plants of fry. There is this to be said, in my opinion, that notwithstanding the fact that the planting of fingerling and yearling fish has been advocated in this country by some for ten or fifteen years, the planting of fingerling fish has not made perceptible headway anywhere and the large work of distribution is still being done with fry.

Mr. Clark: And always will be.

Mr. O'Brien: I don't wish to be understood as advocating the planting of fingerling or yearling fish. I just merely mentioned the fact that we are rearing our bass to an age of six months. It is not done because we thought that fingerlings or yearlings were more successful, it was more because we thought we could transport them with greater safety at the age of six months. That is the reason I should put out the bass in the fall. We have hot weather in June and July, and we are not as well fixed to carry fish as the United States Fish Commission.

Mr. Clark: I don't wish to prolong this discussion, but I want the members of this society to understand the point. I don't care to bring in the yearling question, but the point is, that the black bass is a fish that should not be held and reared, because it is not necessary; because at the end of a week or two weeks they are just as mature as they ever will be.

Mr. Bower: You mean in appearance.

Mr. Clark: Yes, just as well able to take care of themselves as they will be in a year.

Mr. Oberfelder: How about pike? Do you think a pike a week old is as good as one six months old?

Mr. Clark: I have had no experience in the rearing of pike.

Mr. Peabody: I understand you are in favor of fingerlings and yearlings as to trout.

Mr. Clark: I will say I stand just where I did ten or fifteen years ago. In answer to what Mr. Whitaker said and he perhaps didn't wish to be understood just exactly as it sounded, that the yearling theory has not progressed, I wish to say that arises from the fact we cannot raise enough. We can only keep two or three hundred thousand at any station. There is no station in the country large enough to raise a million yearlings. The point is to raise what you can, and as to the balance distribute fry.

Mr. Nevin: Do you mean that in relation to lake trout?

Mr. Clark: Yes, I do.

Mr. Peabody: I am glad to hear you say that. Last winter I talked with the New York people and they are strongly in favor of fingerlings.

Mr. Whitaker: There is no probability, so far as the results are concerned, if you will watch them for the next ten years, that you will find any great increase in their output of fingerling trout. It is impossible, with the multitude of streams we have, taking the great comparative cost of planting fingerlings, to stock the streams of this country with fingerlings.

Mr. Stranahan then read his paper, which follows:

THE MICROSCOPE AS PRACTICALLY APPLIED TO FISH CULTURE.

Prefatory to this paper the writer would say that no one with ordinary intelligence should hesitate to make use of the microscope in fish culture because of any fear that he may not be able to master it.

It is very simple and by the perusal of any one of the many good books of instruction on the use of the instrument, and a little practice, its mastery will come to you with surprising rapidity, and your interest will goad you on until you will find your back and eyes aching, and glancing at your watch, you will dash off for your dinner, conning over some good story on the way to tell your wife as to what made you late.

The most important work of the microscope in practical fish culture is, doubtless, to determine the condition of eggs soon after they are taken so as to remedy early any errors of the spawn-taker which may exist and thus save unnecessary loss.

In examining eggs under the microscope I use a cell that holds about a certain number of eggs, as for instance, in the case of the whitefish my cell holds twenty eggs in a row and five rows deep, making in round numbers 100 eggs, although eggs vary so much in size that this is not absolute.

In making an examination the eggs which are impregnated, unimpregnated and those with ruptured yelks are so easily detected, one from the other, that the cell may be moved under the microscope as fast as you can count.

It is the practice of the writer to examine whitefish and cisco eggs twenty-four hours after they are taken, when segmentation is at its most distinct period. The disc of the impregnated egg will then be found divided into some fifteen or twenty cells, nicely rounded into nodules looking under a half-inch objective as large as kernels of corn. The disc of the unimpregnated egg will be an almost perfect hemisphere and will present a much clearer appearance than the impregnated one. The eggs with ruptured yelks will present a varied appearance. Generally the albumen will be in a layer at the bottom, the oil globules at the top and the disc, much distorted and out of all semblance of the normal, floating between the two. There is another class of valueless eggs, those containing no germinal disc at all, but they constitute a very small per cent., and as, of course, no amount of care on the part of the spawn-taker could put life into these, they need not be taken into account at all.

Thus it will be seen, the eggs at the station can be examined each day, each lot separately, and a record of the work of each and every spawn-taker kept, his errors corrected or the man discharged, and by going over your tables resulting from this work, when you are about to engage your spawn-takers for a season, you can see at a glance who are your best men, weed out the poorer ones and greatly improve your spawn-taking force. Of all occupations, a careless, negligent, dull spawn-taker is the one to be avoided. He should be intelligent, progressive, obedient to orders and as such, should be paid well for his services and retained from year to year.

About seventy-five spawn-takers are employed at the Put-in-Bay station each fall, and it will be apparent to the most casual observer that this plan of examining eggs must result in the securing of a much larger number of good eggs than would otherwise be the case.

The great advantage of the microscope is that you can determine in twenty-four hours whether your eggs are good or not and apply the remedy, while without it, especially in the case of unimpregnated eggs, you have to wait until the season is nearly over before you know the result, and in the meantime you have, perhaps, lost millions of eggs which should have been saved. The writer frequently uses the telegraph in calling delinquent spawn-takers to task and believes that it has paid well on the investment.

Aside from examining eggs to determine their quality, the microscope can be made of use almost daily while eggs and fry are in the house. Many little emergencies arise when you wish to make a closer examination of eggs or fry than you can make with the unaided eye, and it soon becomes a second nature to resort to the microscope.

To illustrate: At the Put-in-Bay station one morning last April, it was discovered that the pike-perch eggs were so light in the jars that it was difficult to keep them from flowing out, although the water had been shut down to a considerable extent. The microscope revealed the fact that colonies of infusoria—mainly the species Carchesium, with a few Vorticella—were so common that it was difficult to find an egg without one or more. The eggs were thoroughly feathered, thus breaking off the slender stems by which the animals were attached to the eggs, when they worked as well as ever and no harm was done further than that incident to the handling of this very tender egg. I will state, incidentally, that this phenomenon had never occurred before at the Put-in-Bay station and I have never heard of it elsewhere.

As is well known to fish culturists, there is a small loss among all kinds of fish eggs after the embryo has formed, what is called in ordinary hatchery parlance "deadeyed eggs." The microscope will be found convenient in studying the cause of this loss. In the whitefish eggs examined by the writer the past season it was found that about 30 per cent. of this loss was occasioned by insufficient food supply, that is, the yelk sack being undersize, the albumen would become absorbed when the embryo would starve to death. This loss goes on from the early formation of the embryos up to the time of hatching, those with the smaller sacks dying first and the others later on.

Malformation causes about 20 per cent. of the loss, beginning early where the embryo is very poorly organized, perhaps having merely the semblance of an organization, with the abnormal brain and a rudimental spinal column and yet with a heart and a system of blood vessels. The eyes in these more erratic forms are usually wanting, and if present are very imperfect, these organs being among the first to show malformation, while the auditory apparatus is among the most perfect.

About eight or nine per cent. of this loss is caused by ruptured yelk sacks, ruptured blood vessels and aneurisms.

With about 40 per cent. of this loss the writer was unable to arrive at the cause. His work was all done in gross, not having a microtome or other appliances for making sections, and not being sufficiently versed in the work to have made use of them if he had been thus supplied. It is probable that one well versed in the various sciences called into action in this work and with better appliances could determine the cause of death in the greater portion of this remaining 40 per cent.

The writer has come to the conclusion that, as in the higher forms, nearly all this loss is the natural weeding out of the more weakly individuals, through that inexorable law which provides for the survival of the fittest, and it therefore follows, if this be true, that no amount of care on the part of the fish culturist can do more than cut this loss down in a small degree. It is probable that care in taking and handling the eggs would reduce the number of malformations and ruptured yelk sacks to some extent, but in the main the death of eyed eggs results from natural causes, which no amount of care on the part of the fish culturist can prevent.

The writer would recommend that fish culturists use the camera in connection with the microscope and thus place the results of their labors in a more permanent form.

With a reasonably good microscope and any camera which has facilities for handling dry plates, photo-micrographs can be made by removing all the lenses from the camera, which can be connected with the microscope either perpendicularly or horizontally according to the egg, whether best viewed from side or top.

and some simple appliance arranged for excluding the light at the union, or, if the lenses of the camera are good ones, they may be left in and better results be thus obtained. The writer pursues the latter course with better results than with the former. When the mrcisocope is well focused the camera will be, no matter whether the bellows be drawn out to the fullest extent or short-focused, the only difference being the size of the picture.

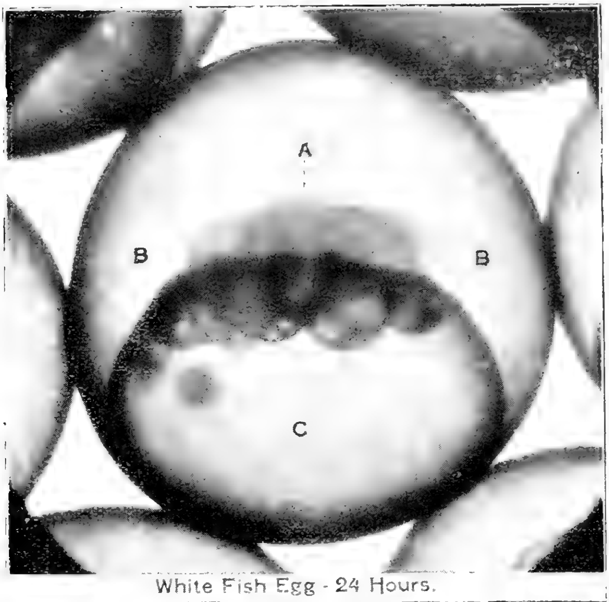
From half a minute with a Welsbach gas burned to five minutes, or a little less with a coal oil lamp will be found within reasonable range for time of exposure but this will have to be determined by individuals by experience.

Quick plates should be used, and Metol developer will be found to be the most effective, giving a wide range, and being especially good where the plate is under-exposed, very likely to be the case where the embryo is sufficiently developed to move in the egg or with fry while alive.

In conclusion, I would say that the making of photo-micrographs is not nearly so difficult as most people suppose and that it can be readily mastered by calling a little perseverance and patience into requisition.

Mr. Whitaker: I want to say a word in connection with this paper, as it seems to me to have great practical value in connection with the stripping of fish. I believe that strippers become ultimately overconfident of their ability and become careless in their work and need just such a correction as this examination by the microscope will give. I think that the percentage of poor ova is due very largely to this overconfidence and poor handling of fish in spawning time. In a manual recently issued by the United States Commission there is an excellent article about the careless handling of fish in spawning operations. It appealed to me to be a very just criticism. It is the rough handling, to a certain extent, that causes the large loss of spawning fish at that time. This use of the microscope as applied by Mr. Stranahan seems to open to the practical fish culturist a very wide field. It is greatly to the credit of Mr. Stranahan that he has taken this work up in the way he has and I imagine in the next few years, if it is pursued by others, a great deal of good will result from its use.

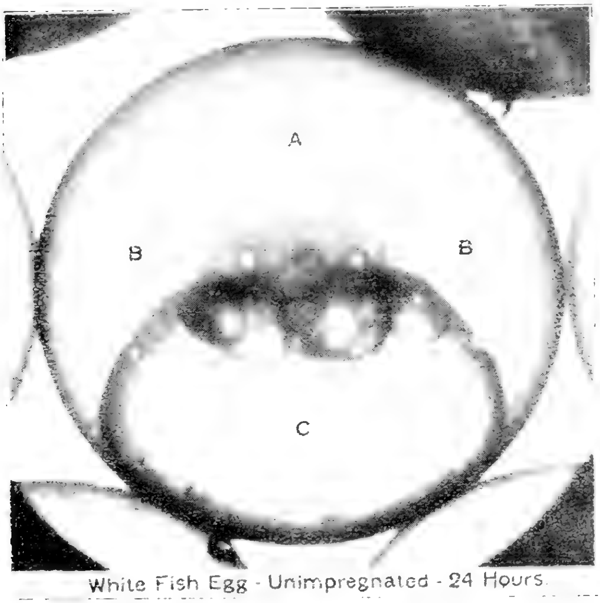
Mr. Nevin: The way we keep track of our strippers is to have our boxes numbered, a number being given each stripper, and we keep track of his eggs; we send notice to the man if his eggs are poor, and if he does not improve we drop him.



White Fish Egg - 24 Hours.

IMPREGNATED WHITEFISH EGG, 24 HOURS AFTER TAKING.

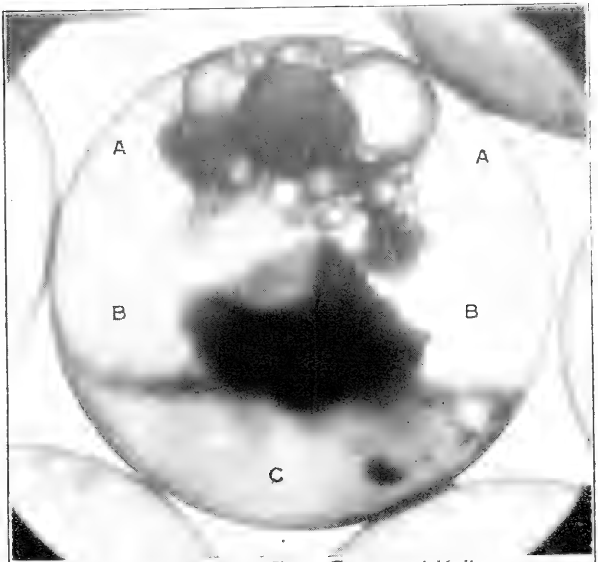
A - Germinal Disc, showing Segmentation.
B - Layer of Oil Globules.
C—Yolk Sac. (Magnified 21 diameters.)



White Fish Egg - Unimpregnated - 24 Hours.

UNIMPREGNATED WHITEFISH EGG, 24 HOURS AFTER TAKING.

A—Germinal Disc, Segmentation not having taken place.
B—Layer of Oil Globules.
C—Yolk Sac. (Magnified 21 diameters.)



White Fish Egg - Ruptured Yolk.

WHITEFISH EGG, 24 HOURS AFTER TAKING, SHOWING YOLK SAC RUPTURED BY CARELESS SPAWNTAKER.

A—Oil Globules.
B—Disrupted Germinal Disc.
C—Layer of Albumen from Ruptured Yolk.

(Magnified 21 diameters.)

Mr. Stranahan: In that case it takes all the way from four or five days to two weeks to determine whether the eggs are fertilized or not, so you may lose by the carelessness of the spawn-taker, a million eggs, while in this way it is determined at once and he is notified by telegraph.

Mr. Bower: I used to be associated with Mr. Stranahan at the Put-in-Bay hatchery when we didn't use the microscope. I am thoroughly convinced that from what he has learned from the use of the microscope, he has got anywhere from 15 to 25 per cent. increase in hatch. That shows that the microscope is of great practical value.

Mr. Clark: I was rather skeptical on the question of the use of the microscope as applied practically, until I visited Put-in-Bay and witnessed its operation. I was instructed to proceed on the same line; I visited Mr. Stranahan's station and Mr. Stranahan showed me how his observations were conducted. I supposed it was going to take him a long time to do it but it did not take more than two minutes before he had figured out what the percentage of loss was and in about five minutes he had the eggs transferred to a photographic plate and in about twenty minutes he showed me the photograph. Any superintendent can do it; it is a very practical thing, especially with whitefish and lake trout eggs. I propose to take up this work, but I didn't get it in time last season to do so.

Mr. Gunckel then read a paper entitled "Fish Culturists," which follows:

THE FISH CULTURIST.

Generally speaking, scientific men, men whose knowledge upon any specific group of objects has been gained by systematic observation, experience, and reasoning, become so absorbed and lost in their work that the public seems to lose interest in them, and they in the public; the latter only appreciating and enthusing when the results have been obtained. The botanist will introduce a new peculiar name, and look serious as he carefully analyzes each sprig, leaf, flower, but the world only cares for what is of personal interest, of pecuniary gain, or of pleasure, and sees only its outward beauty, and praises its rich fragrance, and no one cares whether it comes from the Ladrones or the bottom overflows of the Missouri. So in like manner it can be said of the history of the science of physiology, of chemistry, astronomy, modern electricity, which has harnessed the most potent force of nature for man's use; and of the other sciences of equal importance, requiring deep thought, experience, and seclusion. But to no science can nature claim a closer alliance than the science of fishes. Its branches leading us nearer to nature and thus closer to humanity. It directly appeals to all the finer senses, and the pursuit of its objects leads us into many pleasant places, among the most beautiful realms of God's earthly kingdom.

As the population of the world increases, the demands upon the land and water resources naturally increase. The buffalo, the deer, the wild pigeon, dozens of other American game, are almost numbered with our animal curiosities, and no one has ever suggested a way to replenish the forests. Once gone, forever gone. But when our streams are robbed of food life, our commercial fishes driven from our shores with certain species now almost extinct, the fish culturist finds no trouble in restocking, and in many instances better than before. The grayling, that most beautiful of all inland fishes, almost extinct, in the fish hatchery department of the Trans-Mississippi Exposition you will see young fry by the thousands perfectly at home and but recently brought into this world by our careful fish culturist, soon to be planted in their native Michigan streams.

Since the first meeting of this society on December 20th, 1870, to the call for the present session, men have earnestly devoted time, study and money in devising ways and means, not only to protect the fishes of common waters, to replenish the depleted inland streams, through natural and artificial processes, but to introduce new species. The salmon rivers of the Pacific slope, the shad rivers of the East, and the whitefish fisheries of the lakes are now so thoroughly under the control of the fish culturist that it but remains for the Government of the United States, and each State individually, to give them the same unlimited authority as are given to other sciences of less importance.

Fish culture has been practiced from very early ages. It appears to have been in use in ancient Egypt, and was followed in China, but it was confined to the propagation and rearing of young fish in artificial ponds, with the view of introducing fish not previously found in the locality, or of increasing the supply of desirable good fishes. We find in the Smithsonian Report, 1880, page 149, the following: "The first honor prize, the gift of the Emperor of Germany, was awarded to Professor Baird, as a personal tribute to one who is regarded in Europe as the first fish culturist in the world." As a result, to-day, salmon and trout ova sent from Great Britain have been successfully hatched in Australia and New Zealand.

The great problems that the fish culturists had to meet, and to solve, were first, to prohibit wasteful or immoderate fishing, to aid in maintaining a natural supply. It was soon found that the States made no laws to protect that were really good, until the legislators were of the decided opinion that the fish were nearly all gone. When fish, as a nutritious and nourishing food, became more generally appreciated, it was found necessary to resort to the art of fish breeding to increase the supply beyond the natural limits, rapidly enough to meet the necessities of a constantly increasing population.

If our law-makers will carefully examine the fisheries exhibit of expositions, and particularly the present Trans-Mississippi Exposition, now open to the world, in this beautiful Western city, I am sure they will learn many things of great importance, and feel forever friendly toward the fish culturist, and return home convinced of the necessity of furnishing the people with good fish food, something more substantial than the results of political feuds. As near as I could examine the exhibits, with limited time at command, I am glad to say that those with whom rests the honor and responsibility of its careful preparation and complete representation of a fisheries exhibit, should feel proud that their work is so well done and so complete. As near as possible it embraces the greater part of the subject of the preparation of the fishing products, so particularly interesting to our fresh-water people, and the products themselves, including fish culture and scientific study of the matters relating thereto. There is no exhibit so attractive, and retains the American visitor so well, as an exhibit of live fish. There is no other exhibit at the Omaha Exposition where one is compelled to either elbow his way through the crowd or wait patiently his turn, as the fish exhibit. Hence the importance of improving this exhibit whenever and wherever opportunity affords. It's an educator. It proves a most instructive object lesson to all.

International exhibits give a good opportunity to review the work done in different branches of human activity. To the fish culturist it exhibits the results of his work as can be done in no other way, leaving a lasting, profitable impression upon the minds of the public.

It has been said that Europe originated and developed the various methods of carrying on fish culture, but it becomes an industry only in America, and a very important one from the standpoint of the Government. America within the past few years has done more scientific work, to find out the secret of nature's workings and to bottle Spanish mackerel, than in any year of its history. Limited as may seem the work of the American Fisheries Society, the people owe to the individual members of his Society a debt of gratitude for the efficient work, the complete and thorough knowledge of how to supply the increasing demand of our people for more fish food, the solution of the secret of fish propagation, the adaptation of waters to the various species of fishes transported from one country to another, and so complete will be the work that our inland streams will be stocked with fish from the Philippines and other countries now becoming more familiar to the American people.

It has been said often that fish is the poor man's food, for, unlike any other food product, it may be had for the taking. A fish swimming in the water costs no man labor. In the cold waters of the North there float a hundred barrels of whale oil; covering the ocean's surface off Labrador's rugged coast, dart millions of mackerel. Along the coast of Maine, with its hundreds of inviting inlets and estuaries, waiting the pleasure of the fishermen, float the Atlantic's great variety of food fishes known the world over for their exquisite delicacy and richness of flavor. Farther south lie bushels of oysters, and the Southern waters teem with savory and nutritious food fishes. The fresh water lakes abound in whitefish, pickerel, herrings and other valuable commercial fishes, many of them now the results of the fish culturist.

To the earnest fish culturist it is not always hard work. There are times when he enjoys the fruits of his labor. There are times when the fish culturist feels sad and disheartened because those members of the finny tribe, those who owe to him their existence, fight him. When they passed the fingerling age, the age that always arouses a long discussion, they seem to forget their best friends. In that clear and beautiful Michigan stream there darts a three-pound trout, planted there years ago by the Secretary of this Society, but alas! this unkind trout has brought many a drop of sensible perspiration to the placid features of Hon. Herschel Whitaker, and continues to fan himself as the years roll on, without a sign of recognition.

Under that cluster of western lily leaves, resting after a gorge of a two-pound Missouri sucker, lies in perfect contentment a sixteen-pound Mississippi pike, who has broken many a rod in the hands of Hon. W. L. May.

In the shadows of Put-in-Bay's rocky shores, still playing at will, three and four-pound black bass, "the game fish of our country," glory in the defeat of one of their greatest admirers, in worrying Dr. James A. Henshall, bravely testing the rod of his design, but, alas! too, the good doctor was forced to leave his youthful habits, and now climbs the mountains of Montana, searching for a more gentle bass or for facts on how to catch trout in streams running up hill.

In that quiet stream known for its pious muskalonge, at Chagrin Falls, Ohio, are still three forty-pound monsters of his own raising, who year after year delight in breaking the most complete angler's outfit known to Eastern trade, and seem to laugh at the great fish culturist, J. J. Stranahan, who, in Spanish humility, has retired to the historic waters of Perry's victory for inspiration through the microscope.

Along the meadow streams, whose sparkle and brightness take their source from the hemlock shade, hang verdant branches, extending over pools of speckled beauties, every one known by name, who lay in wait for a graceful drop, but, alas! a fish culturist is seldom a successful fly-caster, and the branches and limbs contain a book of the choicest flies, left there by F. N. Clark, while the trout, propagated by his own skill, know him not.

The push and energy of our American railroad passenger men, in seeking the best fishing lakes and most romantic streams for lovers of the art of angling, has been the means of opening the eyes of our Wisconsin fish culturists, and the Hon. James Nevin, who has just begun to learn how to use, successfully, a Henshall rod, leads the people in seeing that the lakes and streams are over-stocked with fish to satisfy the angler's desire to test their fighting qualities in those deep, cold, clear streams.

On account of Toledo, Ohio, being so closely connected with the good people of Michigan, and that city having more truthful, expert anglers than in all the Western States combined, Seymour Bower finds it necessary to ask his legislator friends to pass a law to "license anglers." He had his eye on Toledo when the suggestion came to him.

Annually the sluggish Missouri overflows its sandy banks and rushes over the bottom lands, changing its current every five minutes; but when it retires within its banks, great pools of water remain, to be cleared, in time, and filled with all kinds of fish inhabiting this muddy stream. Often thousands of black bass are held within its sandy enclosures, and naturally become easy prey to the Nebraska angler. Under the shadows of bottom sycamores, W. H. O'Brien, Omaha's favorite son, annually seeks a favorite casting spot, and on account of reasons better known to himself and his fair companions, he has yet failed to land a single bass. Broken rods line the banks; tangled lines are in the branches of the trees. As a remedy, Mr. O'Brien proposes to "propagate a bass that will bite at worms and hook themselves," as illustrated in his paper before this Society to-day.

To the fish culturist belongs the honor of adding to the natural and artificial lakes and streams of the East the many species of trout from the Western waters, adding beauty and profit and pleasure to man. It remains for the fish culturist to suggest, and follow the suggestion by active work, the necessary remedies for increasing our fish food supply. The Government looks to educated, experienced men to handle successfully our navy. It must look to the educated, experienced fish culturist to solve the problems of how to increase our fish supply. The statute books of our States are crowded with laws which no one understands, least of all the men who made them, and which for obvious reasons, the Fish Commissioners, are powerless to enforce.

In 1903 the patriotic and public-spirited people of the great State of Ohio will appropriately celebrate the centennial anniversary of the admission of that State into the American Union. It is their purpose to make an exposition of the wonderful development of Ohio in financial, industrial, commercial and social lines. Taking time by the forelock, which is the habit we have in Ohio, the General Assembly, at its last session, enacted such legislation as seemed necessary to carry out the expressed will of the people that Ohio's centennial anniversary be duly commemorated. In their wisdom, the members of the General Assembly selected the rapidly-growing city of Toledo as the most desirable site for such an exposition as might naturally be expected from such a State as Ohio. Ohio was carved out of the old Northwest Territory, and Toledo, resting on a magnificent harbor a few miles from the extreme southwestern end of Lake Erie, is the most central point, geographically, of that territory. We have, too, easy access to all parts of the country by way of our splendid network of railways. On this occasion it should not seem strange if I obey the natural and ungovernable instincts of the true fisherman and extend to this Society, the individual members, and all fish culturists and friends here assembled, a most cordial invitation to prepare themselves for a display worthy of our Association. And on behalf of the hospitable people of Ohio let me include in this invitation the good people of the entire great West, whom we would be, indeed, delighted to have with us. In the light of the past deeds of our

State we feel safe in saying that Ohio doeth all things well, and that this exposition, at Toledo, in 1903, will be an Ohio exposition in every sense of the word.

Mr. Clark: I think that we had better take a recess at this time, as it will crowd us considerably to attempt to close our business this afternoon. There is one paper especially that I am very much interested in that is yet to be read, Dr. Henshall's paper.

On motion, the Society took a recess to 2 o'clock p. m.

AFTERNOON SESSION.

Two p. m.—The meeting was called to order by President May, and Professor Birge read a paper entitled:

THE RELATION BETWEEN THE AREAS OF INLAND LAKES AND THE TEMPERATURE OF THE WATER.

Mr. President and Gentlemen: I am going to speak this afternoon on the subject of the temperature of the small inland lakes, especially as affected by the area of the lake. For the last two or three years I have been working on the biological condition of the inland lake, taking up one point at a time, as my leisure from the University work will allow me to do it; for the past season I have been working on the temperature. The main work I have been doing is on my own lake Mendota, immediately adjoining our University. During the last open season I had temperatures taken of the water at all depths, twice a day during the season, and during the present season from the first of May on, I have been continuing the taking of the temperatures in that same fashion, and I expect to continue the work to the end of the season, hoping thus to get a tolerably complete idea of the changes of the temperature of the lake. In connection with this work I have been carrying on, especially this season, observations of some of the smaller lakes, at Oconomowoc, about sixty miles from Madison. The special point of these observations has been to see what the effect of the area of the lake would be on the depth to which the heat of the sun penetrates into the water.

The temperature of the water is one of the most important biological conditions in an inland lake. The temperature of the surface starts in spring from 32 degrees, and rises in summer to the very considerable height of 70 or 80 degrees, and falls again at the close of the warm season to the freezing point. This great gain of heat during the summer is caused, of course, by the action of the sun. The questions I have been trying to determine are these: How far does the heat of the sun penetrate into the water, and how does it get down to the depth which it actually reaches?

The heat of the sun falls on the surface of the lake, and there are three ways in which the heat may penetrate through the surface to the deeper water. In the first place, it may go down by conduction; the warm water warming by conduction the stratum immediately below it. This method is practically of no importance. The power of the water to conduct heat downward is so small that it may be entirely neglected.

The second way in which the heat may get down is by the direct action of the sun shining down into the water, penetrating it and warming it as it goes. This method means a good deal more than conduction, although it means a great deal less than is ordinarily supposed. By far the greater part of the heat of the sun is stopped by the first layers of the water and gets no further. All the heat that belongs to the dark portion of the sun's rays is stopped by a very thin layer of water, and that part which is in the luminous portion of the spectrum is very rapidly absorbed, especially if there are plants or other opaque particles in the water. If, then, the temperature of the water depended on the penetration of the sun's rays, and if the water were entirely undisturbed by the wind, we should find a high temperature only to a very small distance from the surface, and then we should find a very rapid change to cold water below.

But as a matter of fact, our lakes are exposed to the action of the wind, and this action constitutes the most important means of distributing the heat of the sun to the layers of water below the surface. The action of the wind sets up currents in the water, which distribute to a greater or less depth the heat which the surface secures from the sun. As a matter of fact, we find in the middle of summer a layer of water, often 20 or 30 feet in thickness, which has been almost uniformly warmed by the sun. The thickness of this layer depends not on the depth to which the sun's rays penetrate the water, but on the action of the wind distributing to a greater or less depth the surface layers which have absorbed the heat of the sun.

It follows from this method of distribution that the depth to which the water is warmed will depend upon the action of the wind, and if lakes in the same region are compared, which are equally exposed to the influence of the sun and wind, the amount of warm water on the surface and the depth which the heat of the sun will reach will depend very largely upon the area of the lake; or, in other words, if you compare lakes in the same region and of approximately the same depth, you will find that the temperature at any given depth will be less as the area of the lake is smaller. In order to illustrate this point, I have brought in a diagram on which I have platted the temperature curves of four lakes. The largest of these is Lake Mendota, 6 miles long, by 3½ miles wide, and about 85 feet deep. The second is Okauchee Lake, about 2 miles by 1½, and 95 feet deep. The third is Mouse Lake, about 1 mile by 1-3 of a mile, and 60 feet deep. And the fourth, Garvin Lake, is about 1-4 of a mile long and half as wide, and about 40 feet deep.

The temperature of these four lakes was taken on the same day, on the afternoon of the 12th of July, 1898. If you look at the curves you will see in the first place that the lakes have substantially the same surface temperature. They are all within about one degree of each other at the surface.

Secretary Whitaker: All taken at the same hour?

Prof. Birge: No; because one has to go from one lake to the other.

In the accompanying diagram each vertical space represents 10 feet in depth of water, and each horizontal space represents 5 degrees Fahrenheit of temperature. The temperature of the water in each lake was taken at every meter of depth, the result platted in the diagram in its appropriate place, and the points so marked connected for each lake by a line. Several things appear plainly from the diagram. In the first place, the layer of warm water at the top of the lake is thinner in the case of the smaller lake. In Garvin Lake this layer is about 13 feet thick, while in Mendota, the largest lake, it is nearly 30 feet in thickness, and in the two lakes of intermediate size it is of an intermediate thickness. This shows, of course, the depth to which the wind has thoroughly distributed the warmer surface water of the summer.

A second fact which is very plain is that at equal depths these lakes have a very different temperature. At 30 feet, for example, Garvin Lake has a temperature but little above 45 degrees, while Mouse and Okauchee Lakes have temperatures about 10 degrees higher, and Mendota has been warmed at this depth to a temperature of more than 67 degrees. Similar relations appear at all depths below 10 feet; the larger lake in every case having a higher temperature at any given depth than the smaller lake. A third fact appears with equal clearness, namely, that the temperature at the bottom of these four lakes is very unequal. In Garvin

Lake, the smallest, the temperature at 37 feet is as low as in Mouse Lake at a depth of 60 feet, and in Okauchee at a depth of more than 90 feet. All three of the smaller lakes have a bottom temperature 5 or 6 degrees lower than that of Mendota at a depth of nearly 80 feet. This feature of the temperature also depends on the action of the wind. The water at the bottom of a lake acquires most of its warmth between the middle of April and the middle of May, and the amount to which the bottom water would be warmed is largely dependent on the action of the wind during that month. It follows, of course, that the larger lake will acquire more warmth than the smaller lake. As the season advances the gain of heat at the surface is so rapid that the surface water becomes warm to such an extent that the wind is unable to distribute it through the deeper water. This condition is reached earlier in the smaller lake, and the time during which the bottom water can gain heat is consequently shorter, and the effect of the wind is smaller during this time. The bottom temperature is therefore lower.

You see, therefore, that the water in lakes of different sizes may possess a very different temperature at the same depth, and that the bottom temperature of a small lake is likely to be lower than one would expect from its depth only, and that of a large lake is likely to be higher than its depth alone would indicate. In Garvin Lake, indeed, at a depth of less than 40 feet, the bottom temperature is about as low as in Lake Geneva at a depth of nearly 150 feet, or in Green Lake at a depth of nearly 200 feet. This is because Green Lake and Geneva Lake are seven or eight miles in length, and are therefore exposed to a much greater action of the wind.

I don't know that I ought to say that these considerations have any immediate practical bearing on fish culture, but I think that any one must see that the small lake, with its shallow water and cold bottom temperature, must form a different kind of home for the fish from that afforded by a lake of equal depth but different area, and consequently different temperature.

Mr. Whitaker: How about the shallower lakes? Is the source of supply the same as that of the others? Are they spring fed?

Prof. Birge: Yes, I believe they are spring fed; the temperature of the spring water is very close to 50 degrees, so that the temperature here at the bottom of this lake is now four or five degrees cooler than the temperature of the spring water. There

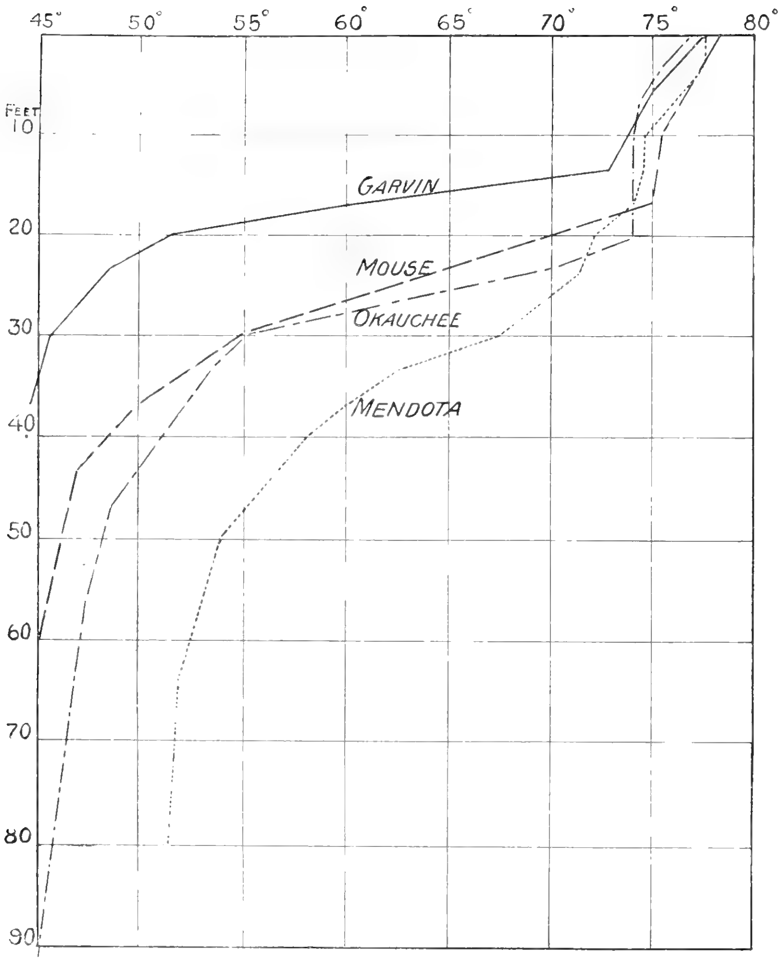


DIAGRAM TO ILLUSTRATE THE EFFECT OF AREA ON THE TEMPERATURE OF LAKES.

(Observations, July 12th, 1898.)

is a spring which I have tested about a mile from Garvin Lake whose temperature is about 50 degrees.

Mr. Whitaker: Have you ever made any observations with reference to the abundance of plants at the bottom of the lake?

Prof. Birge: No; I have not had time to take that up.

Mr. Whitaker: Do you know at what depth in these lakes the growth of plants stops practically?

Prof. Birge: It wouldn't get down to that cold lower water, anyway. You don't get a great many springs in the bottom of a lake. As a matter of fact, the spring would be more likely to come out near the level of the lake than further down. The spring comes from the head of water that is in the soil. When you get down below the level of the soil water there is less head of water. So the spring will ordinarily work out of the edge of the lake or in shallower water.

Mr. Whitaker: I believe the investigation of Lake St Clair showed that the bottom of the lake was covered with a perfect mat of chara. As I understand it, on all lakes there is a certain shore zone, bare of plants; made barren by the action of the waves, which prevents the growth of plants.

Prof. Birge: Not in these very small lakes. In Mendota, except at sheltered places, the wind affects the plants to a depth of $3\frac{1}{2}$ to 4 feet.

Mr. Peabody: What is the greatest depth that the action of the wind reaches so as to modify the temperature?

Prof. Birge: So far as I know, its action extends to the greatest depths of our inland lakes. Green Lake is 237 feet in depth. The temperature of the water at the bottom rises during the spring and falls during the late autumn. I cannot conceive that this change is due to anything but the action of the winds.

Mr. Bower: I think your statement explains why some of the Great Lakes are more prolific as to production of fish than others. I understand that the greater amount of water life, the greater vegetation, the greater amount of fundamental life, the larger the higher forms of life. Of our Great Lakes there is no lake that begins to compare with Lake Erie in the amount of fish caught. There are large areas that are sheltered, but still subject to the action of the wind all the year, in a degree; that accounts for the reason why the most productive places are the bays; take all the bays on the Canada shore, and Saginaw and Green Bay, and they are by far the most productive areas. We get more fish in those parts of the lake than all the rest of the lake; don't you think that temperature in a great measure accounts for it?

Prof. Birge: I have no doubt that this has influence; but I don't really feel that I know anything about the problems the Great Lakes offer in regard to temperature. The shallow nature of Lake Erie must permit the sun to warm it up; you get the whole heat of the sun concentrated on the shallow water. While the heat is projected to a slight depth only in Lake Michigan, it produces a great deal of warmth in Lake Erie.

Mr. Bower: Take the whole of Lake Erie west of a point drawn across the lake from the east part of Sandusky Bay and there is not a spot anywhere that exceeds 46 feet in depth. There is a vast area there of a great many square miles.

Prof. Birge: The temperature at the top and bottom would probably be about the same.

Mr. Bower: It would seem from your explanation that the lake would be stirred from top to bottom.

Mr. Gunckel: I don't think there is probably any question that in the upper end of Lake Erie, the locality Mr. Bower has spoken of, that in the fall it is stirred from the action of the waves and wind, from top to bottom. From the fact that in very heavy winds when the whitefish are on, they are driven off when these heavy winds occur, and it must be stirred from top to bottom.

Prof. Birge: I might say also, where you don't get the water roiled, the wind has a great deal of effect on temperature; take it in Lake Mendota, the wind does not stir the water up from the top. There are horizontal currents which are moving around, which must produce a great deal of effect on the temperature. You will see in the diagram little irregularities in the temperature, which were not to be accounted for by the warming of the water. At 12 o'clock the temperature would be up a degree, and at 3 o'clock it might be down, and at 6 o'clock it might be up. We found continuously little fluctuations in the temperature which could only be due to currents flowing more or less horizontally.

Mr. Bower: I remember when I was a boy and used to go in swimming, we used to suddenly plunge into water that was perceptibly colder; it would only be just for a few feet and it would be warmer again.

Prof. Birge: That experience you will get, ordinarily, in the early part of the season, but not later than the 1st of July.

Mr. Whitaker: I suggest if there is no more discussion on this paper that we read one more paper and take a recess until to-morrow morning at 9 o'clock.

Dr. J. A. Henshall's paper was then read, which follows:

SOME PRELIMINARY OBSERVATIONS CONCERNING THE ARTIFICIAL CULTURE OF THE GRAYLING.

The grayling of Montana exists only in the tributaries of the Missouri River, above the falls, but principally in the three forks of that river, the Jefferson, Madison and Gallatin Rivers, and their tributaries.

In 1805 Lewis and Clark found the grayling near the headwaters of the Jefferson, and in the history of their wonderful expedition spoke of it as follows: "Toward evening we formed a drag of bushes, and in about two hours caught 528 good fish, most of them large trout. Among them we observed for the first time ten or twelve trout of a white or silvery color, except on the back and head, where they are of a bluish cast; in appearance and shape they resemble exactly the speckled trout, except that they are not so large, though the scales are much larger; the flavor is equally good."

This fish was not subsequently identified from this description, though any one acquainted with the locality and the fishes of the headwaters of the Jefferson could not doubt for a moment that the grayling was meant. Dr. Elliott Coues in his edition of the History of the Lewis and Clark Expedition, thinks the description applies to the blue-backed salmon (O. nerka) of the Pacific coast, though he says this genus is not known to exist in Atlantic waters.

In a recent communication to "Forest and Stream" I have advised the adoption of the name Thýmallus lewisi for the grayling, on the strength of Lewis' description, and to relegate to synonomy Cuvier's name of Thymallus ontariensis, based on a specimen, the locality of which is unknown, though it was wrongly attributed, as I believe, to Lake Ontario.

Seth Green and Fred Mather claim to have hatched the grayling artificially from eggs procured in Michigan in 1874. Seth Green has a brief notice in his "Fish Hatching and Fish Catching" of the hatching of about 100 eggs, but says nothing, except in a general way, of feeding and rearing the fry. I have an impression that Mr. Mather has reported his operations at greater length, but I do not remember just when and where his account was published.

The first real effort in this direction was inaugurated last spring by the United States Fish Commission at a sub-station connected with the Bozeman (Montana) Station, and situated on the inlet (Elk Creek) of Red Rock Lake, the headwaters of the Jefferson River. This auxiliary station was in charge of Mr. A. J. Sprague, who was detailed from the Leadville Station, and worked under my direction.

Mr. Sprague took some 3,000,000 grayling eggs, 1,000,000 of which were hatched and planted in Elk Creek. Fifty thousand eyed eggs were shipped to the Manchester (Iowa) Station, 50,000 to the Leadville (Colorado) Station, and 10,000 to the United States Fish Commission Exhibit at the Omaha Exposition, all of which, by extra precautions in packing, arrived at their destination in good condition. About 1,500,000 were shipped to the Bozeman Station, but many were lost, owing to a lack of ice for packing the eyed eggs. Some green eggs were shipped as an experiment, and though seemingly in good condition on arrival at Bozeman, they all died soon afterward.

These eggs were shipped over a wagon road some sixty miles in a common farm wagon, without springs, and called by courtesy "a stage," from Red Rock to Monida, Montana, thence by railroad. The drive of sixty miles is made in one day, by relays of horses, and as the drivers are required to "make time," the eggs were subjected to much jolting.

The problem of transportation of eyed grayling eggs, however, has been satisfactorily determined. As the period of incubation is so short, it is absolutely necessary that the temperature be kept between 40 degrees and 50 degrees, say at 45 degrees. This can be accomplished by packing ice and dry moss beneath, around and on top of the stack of trays in the egg-case. A good plan, also, is to place an extra ice-hopper, in an inverted position, over the usual hopper; this answers the double purpose of keeping the moss dryer, and also allows more ice to be used on top. It is of the utmost importance that the eggs should not be subjected to the least pressure during transportation. There should be very little, if any, moss placed over the eggs or between the egg-trays. Any pressure on the eggs causes fungus to develop, and is fatal to the life of the embryo.

About 500,000 eggs were hatched at the Bozeman Station, and at least 50 per cent. of the fry are alive, and most of them are feeding.

In stripping the female grayling, the eggs are a little harder to start, but are then extruded more freely than in the case of the trout. About 3,000 eggs is the average for a fish of twelve inches in length. The eggs are white and as clear as a crystal; they are smaller than the native trout (S. mykiss) eggs, but after impregnation and the absorption of water will average one-seventh of an inch in diameter, while the native trout eggs are one-sixth of an inch, and the brook trout (S. fontinalis) eggs are one-fifth of an inch in diameter.

Soon after fertilization the eggs become glutinous and adhesive, forming bunches or masses of various sizes, when fungus rapidly develops and kills the egg. This renders the work of picking laborious but imperative. The embryo develops rapidly, and is in constant motion, often causing the egg to roll over on the tray. The grayling eggs are lighter than trout eggs, almost semi-buoyant, and from our experience would be better hatched under a pressure of water from below. In an improvised jar they did well, and the bunching and development of fungus did not occur. Perhaps the method followed with pike-perch eggs in using starch or muck might cause the eggs to separate, and the bunching be prevented. Next season I propose to experiment with fine quick-sand, so-called, which is abundant about Red Rock Lake; it is more like fine marl, as fine as wheat flour.

The embryo begins to show life and motion before the eye-spots are visible. The eye-spots are small gilt specks, with a minute black pupil, and appear in from three to five days. The period of incubation is from 10 to 12 days, at a temperature of about 50 degrees. The fry are hatched with a very small yolk-sac, about half the size of the egg, and which is absorbed in about a week, when the fry immediately becomes a free-swimming animal, about one-half an inch in length, and is quite slender and delicate. They do not begin to feed so readily as trout, and require constant coaxing, as often as every half hour, with liver as finely divided as possible, being in fact bloody water. The best method of feeding and rearing is yet to be determined. Those hatched and planted in Elk Creek did well, being double the size, at the same age, of those hatched at Bozeman Station, which proves that we must follow, as closely as possible, the natural conditions of breeding.

The grayling does best in sandy and gravelly streams, with swift and pure water. It is a much superior fish for the table than any of the trouts, and in game qualities is their equal. As the species is rapidly disappearing, it seems to be important that so good and beautiful a fish should be preserved by artificial propagation, and no reasonable efforts should be spared to determine the conditions best suited to its successful culture.

Mr. Clark: This work of Dr. Henshell is a matter that I am very much interested in. In the year 1885 the United States Fish Commission gave me instructions to proceed to the Au Sable River to investigate the spawning of the grayling, and I will say, by the way, that I kept a report of that trip, and meant to have it here. At that time Mr. Bower was my assistant. He was dispatched to the Au Sable and we succeeded in obtaining a few grayling eggs. I think there were 25,000 taken to Northville. Of that number, 5,000 were shipped to Washington, and from there sent to Wytheville, Virginia. There was no difficulty in shipping them. The experience we had in hatching them was something different from the Doctor's. We had no trouble about the eggs sticking any more than with trout eggs, and they didn't bunch up after we had them on the trays. They of course adhered slightly, but after you had separated them there was no bunching. We had no difficulty in hatching them; the difficulty with us was in raising them after they were hatched. The time we used in hatching in a temperature of probably 55 degrees was from fourteen to twenty days. At the time Dr. Henshall was about to commence the work I received a letter from my chief, Mr. Ravenel, in Washington, in reference to the Doctor's taking hold of that work, and he asked me what I would suggest as an apparatus for hatching. I suggested the jar if they were to be handled in large quantities. I see the Doctor did try the jar. I don't know whether you gentlemen have seen the young grayling at the Exposition grounds, but when you do I think you will say they are different from the young grayling we hatched in 1883.

Mr. Bower: At the time we attempted to secure the grayling from the Au Sable and Manistee Rivers, those streams were literally filled with logs. Of course, the fish at that time of the year didn't bite freely, and the only way we could get them was by bottom fishing, using worms or minnows. The opportunities for fishing were limited to occasional open spaces in front of where logs had lodged. We succeeded in getting between 40 and 50 adult grayling, none of which were ripe. We held them in crates a few days, until ripe, and in this way secured about 50,000 eggs.

They were quite different from Dr. Henshell's in color. He speaks of their being white. Ours were not white, but translucent; in fact, they looked about like the Lake Superior whitefish eggs. On two points there seems to be a radical difference. One is that our eggs were non-adhesive, and the other is that they were not white.

Mr. Clark: I would like to state further that Mr. Bower sent down to Northville a certain number of adult grayling, and among them I found a ripe one the same day they arrived. We took the eggs from that fish and they amounted in number to a little over 5,000.

Mr. Peabody: Your experience in Michigan is that it is not profitable to raise them? Have you succeeded in doing it to any extent?

Mr. Clark: We have not succeeded well with them.

Mr. Whitaker: I haven't any doubt in my own mind that there are marked differences in the habits as well as the character of grayling in localities remote from each other. The European grayling and the American grayling differ, and very likely there are differences between the grayling of Montana and the grayling of Michigan.

The streams lying in the upper half of the lower peninsula of Michigan originally contained nothing but grayling and the fish were so plentiful that a lady living at Reed City told Dr. Parker, a former member of our Board, that she had seen farmers come there at the time of grayling spawning, and from under the apron of the dam, with an ordinary pitch-fork, fill a small wagon-box with grayling. The grayling, however, have practically disappeared from nearly all our streams. I have come to the conclusion from my experience that their decadence is chiefly owing to the fact that the spawning season, coming as it does, just before the breaking up of the ice in the rivers, filled as they are with logs, it follows that the logs plow up the beds and destroy the eggs, and that log-running is responsible for the disappearance of these fish from our streams. I introduced a resolution in the Michigan Board of Fish Commissioners at one of its meetings in 1878 to stop the further planting of brook trout in grayling streams and their tributaries. I urged that it was not policy to cease trying to propagate the grayling, and that we should make some experiments looking to the planting of the grayling in waters in which they were indigenous. We passed the resolution and such steps were taken. We subsequently organized an expedition, quite a number of spawning grayling were obtained, and the fish were held in a preserve where they might spawn naturally. I never was entirely satisfied with the care exercised over those fish in that experiment, but as a matter of fact, it resulted in nothing. We tried it two or three years, but it failed. Seth Green once said to me: "Whitaker, you will never be able to raise the grayling; he is an Indian, and won't stand domestication." And it seems as though he was right.

I don't coincide with the professor's ideas as to their edible qualities. I do not think they can be compared with the brook trout. For fighting qualities they rank well; for the novice fly fisherman they are the fish par excellence, because any greenhorn can get him. Dr. Parker once told me that on a branch of the Manistee River he noticed a little grayling rising to natural food on the surface, and he counted that he rose twenty-seven times.

It seems to me after the experience we have had, that it is a loss of time to try to do anything with the grayling. He isn't worth the trouble. The brook trout is a superior fish in every respect, and responds so kindly and readily to the methods of propagation that it is hardly worth while to do anything with the artificial culture of the grayling. I hope Dr. Henshall will succeed. He is a careful man, a painstaking man, and it is quite possible in that country where the streams are not subjected to log running he may succeed. I think it may be possible that this massing of eggs he speaks of is due to the injury they received in the sixty miles of haul.

Mr. Clark: As a partial answer to Mr. Peabody's question of why we abandoned the work, I should say, as Mr. Whitaker has said, that they are not easily domesticated. At Northville we proved, beyond a doubt, that you cannot do anything with the grayling in confinement. You have the fish, but you simply cannot get any eggs from them. This was also the experience of Mr. Babbitt, of Michigan, who has also experimented with them. I sometimes feel it is too bad that the grayling in Michigan streams are going. I wish the Commissioners might have reserved one stream until log-running was finished. It might be well for the United States Commission to bring some of the Montana grayling and plant them in some of those streams, because they never can do any hurt; they never eat any trout; it cannot do the harm the brown trout of Germany do. I don't think it is practical to undertake to get grayling eggs in Michigan now.

Mr. Whitaker: It is possible we may always have a few grayling in Michigan.

Mr. Peabody: I would like to ask about the temperature required for grayling. Will they stand as warm water as the trout?

Mr. Clark: No; I don't think they do. The Au Sable River is 65 degrees when the air temperature in the shade is 98.

On motion a recess was taken until 9:30 a. m. of Friday, July 22d.

FRIDAY MORNING SESSION.

Friday, July 22d, 1898, 9:30 a. m.

The meeting was called to order by Vice-President Peabody.

Mr. Whitaker: We have three papers yet to be read. The first is by Dr. Bushrod W. James, of Philadelphia, entitled, "The Protection of the Pacific Coast as Related to Food Supply."

Mr. Whitaker then read Dr. James' paper, which follows:

PROTECTION OF THE FOOD FISH SUPPLY ON THE PACIFIC COAST AND IN ALASKA.

The great abundance of excellent fish in the northwestern waters, the revenue from which in years past has mounted into millions of dollars annually, would suggest to many persons that the consideration of systematized protection regarding them was entirely superfluous at this time. Yet a cursory glance at the history of the larger animals, whose habitat has been the Pacific Ocean, Bering Sea and the Arctic Ocean, will be irrefutable evidence that it is better to agitate the question before the lesser fish have been threatened with extinction. In the class of valuable fishes in Alaska the great mammals of the water have always been included, but of one of the most important, the seals, nothing can now be said, as their protection, having been submitted to arbitration, must depend upon the decision so secured; time alone being able to demonstrate its efficacy.

Whales, sea lions and walruses, however, remain without any safe-guard, and their annihilation has been imminent for several years. As food fish they have always been most valuable to the natives of the territory, as have been the same family of creatures to the inhabitants of Greenland, on the Atlantic coast. The neglect to provide some protection to the Atlantic whale is well known to be most disastrous, the whaling fleets having found themselves compelled to quit the business because of the scarcity of their prey, until now, it is stated by an influential journal, that if it were not for the occasional success of whaling in Alaska, the business would be completely degenerated. As it is, the falling-off has been so great that even the Pacific whalemen are turning their talents in another direction. The great value of this animal to merchants is well known, but now the reduction of the quantities of bone and oil has sent the prices upward phenomenally, putting them beyond the tradesmen, who find few consumers willing to pay the advance, rather accepting cheap substitutes instead.

But it is of them as the life support of Alaskan coast natives that I am inclined to speak at present. Until another mode of supplying food, clothing, shelter, boats and fishing implements, and even fuel, has been instituted for the extreme coast natives, they must have whales and walruses, or perish. It is the diminution in the number of these that has sent tribes of natives far from their usual resorts. It has been the seasons when only one or two of the great animals appeared that have made primitive settlements desolate and reduced the inhabitants to pitiless destitution. This state of affairs has not been sounded from one end of the world to the other, because the Alaskans are neither a warlike nor a complaining people.

For the sake of humanity, as well as for the very momentous item of wealth, there should be legislation limiting the catch of all other mammals as well as their acknowledged superior, the seal, until they have been permitted to increase, and after that there should still be a close guard against over-stepping a proper margin. It is not yet too late, but delay will certainly lead to the total destruction of a once most lucrative traffic in bone, oil and ivory, for the latter of which the immense walrus was hunted until his presence is seldom found in his former haunts.

The history of these fisheries will tell how all the civilized world sent large fleets for the capture of the animals, and how reports gave glowing accounts of their inexhaustible numbers.

But what were they in comparison with the millions of salmon than can literally be forked out of the water as fast as a man's arm can use an ordinary drag net? They are said to haunt some of the rivers during their run in such compact masses that the barefoot natives can walk over them and dip baskets down into the moving schools, removing hundreds, only to make room for thousands more. Speculation has pointed the way, and canneries have appeared with enormous capacity. It was so in Karluk River some years ago; now, the United States Treasury Department has officially stopped salmon fishing in Karluk, except that sufficient fish may be captured to supply the hatcheries along the river banks; and this is done to prevent threatened depletion. Yet it is stated that the Pacific coast fisheries will require about 80,000,000 cans for their year's catch, as they have used that number annually for several years. Many of the fish are taken in traps, and from 10,000 to 40,000 salmon are taken in one trap. It must be remembered that all this number cannot possibly be choice, and there is no doubt that thousands are wasted because of undersize or non-marketable quality. But to remedy this defect some companies have permitted them, and the different kinds of fish taken with them, to appear under the same label as the better article. Dealers have fortunately discovered this, and the only thing for the canners to do to redeem their reputation is to exclude all but the finer quality, as they did heretofore. Perhaps there has been some excuse for this in the falling-off of the Columbia River salmon, whose excellent qualities have created an enormous demand, and in filling standing orders the workmen may have in haste made mistakes in the canning. Or, more probably, inferior qualities have been carelessly handled among the better and received the sign manual that had belonged previously to none but the superior article. Possibly disaster has befallen some firms through this unprofessional handling. But the streams are still so well stocked with the fine grades of salmon that no one need suffer long who has the energy and the capital to start in anew, with thoroughly reliable stock.

The "Royal Chinook," whose magnificent proportions have often tipped the scales at eighty-five pounds, whose beautiful deep-pink flesh has charmed the epicure, is still abundant in the North-West, though a little caution in the catches will be necessary to keep up the supply. But he has a rival, so small as to seem at first hardly worth fearing; its name alone being anything but attractive. Yet, the little six to ten-pound "sock-eye" has certainly swam to the front. Its beautiful red, firm and richly-flavored flesh, and its preserving qualities, have nearly overshadowed its royal brother, as well as the Alaska salmon of the greater rivers. But here come announcements of new companies who will pack nothing but "sock-eye." Puget Sound fisheries, wherein the fish are caught on their way to Fraser River, are preparing to take greater numbers than they did before, for the reason that the exports call for the rare, new commodity. More canneries are to be erected at Astoria for Columbia River salmon, at Fairhaven for the Puget Sound fish. In Washington, new traps are to be put in place for the expected rush of the salmon. Companies are forming and locating for salmon fishing. Cold storage plants are being erected for the salmon catches in different parts of Alaska, Washington, Oregon and British Columbia. A Dane has patented an arrangement by which fish can be carried great distances while still alive, and the device is to be used in carrying salmon as far east as the fish will keep. The result of all this must be distinctly foreseen by any thinking person. One day, not far distant at this rate, salmon will be so scarce that the canneries will be forsaken and capital taken in another direction, whereas, if the Treasury Department or its representative Fish Commission, will place restraining measures upon this evident wholesale grasping, confining the seasons, prescribing the fishing until a number of the strong, finer fish have had time to reach the spawning grounds, and thus perpetuate their species; the salmon fisheries will not be exhausted as they must be soon, judging from the stupendous preparations that have been made for their extermination.

One manner of preserving them as well as other fish, is by allowing a fish-way in every dam, by prohibiting the erection of enormous traps and wheels that must soon depopulate the waters of all kinds of fish, unless it is expected that fish themselves will discriminate and keep out of the way; by insisting upon limited seasons, and by also requiring companies to avoid over-production of their commodities. It is not desirable to keep fish, particularly, from season to season. The fresh article is always in demand, but there is a certain modicum of danger in keeping them over. Having estimated the quantity required for a year's trade, it would be only diplomacy to stop at that, and let the fish have liberty to grow and multiply. Our Fish Commission is cognizant of this, and with Government to legislate there will be no danger of the salmon canning business becoming a failure.

It has been said of Americans that they are greedy for wealth, but the desire for revenue from fish has dominated every nation, and when our laws are prepared for the protection of salmon in Alaska and Puget Sound, we will evidently be required to gain the co-partnership of British Columbia, else some of the more valuable kinds will not be fully guarded.

Another great fishing scheme is being advanced rapidly of late, for the taking of sturgeon, Pacific sturgeon being found finer flavored, firmer in flesh and better for keeping than the Atlantic fish. Possibly, there is little wonder for this when we think of the pure, almost unknown waters in which the former live, and the uncleanly waterways in which many of the Atlantic sturgeon are caught. In Fraser River the sturgeon has been found of great size and richest flavor. One fish was taken that weighed over 900 pounds. This fish is to be shipped by cold storage; the roe will be sent to Russia for caviare making, and the Chinese prize the spinal cord after it is dried. There seems to be no idea of canning the sturgeon, though it has been whispered that the same has been found masquerading as salmon in some grades of canned goods. Sturgeon is sufficiently well known to be appreciated under its own name if it is properly handled. And here a word with regard to the matter of handling. I think the fisheries are endangered by the manner in which many fish are marketed. Perishable as they are, the housewife is cautions in purchasing unsightly fish, and the Commission should ask for local legislation that will dominate the sale of fish in every market. If this was established, more fish would be used and less left to waste offensively. Thus far there is unquestionably an over-production of all but a few choice varieties. With careful manipulation all fish would be more tempting, and if the purchaser did not see the fish that was wanted she would possibly take another not very inferior. To protect the fishing interest everywhere, the fish should be delicately handled to prevent unsightly appearance, and they should be fresh beyond all doubt.

To prove that a limitation of the catches of the different fisheries will permit the numbers to attain a certain annual average, we will find that the species that have thus far been allowed comparative freedom are found in amazing quantities in their haunts. Smelts and herring, perch and pompano, cod, halibut and mackeral, trout and many other varieties can actually be captured by the ton in virgin waters. We must look to it that none of them are so captured until the waters are suddenly depleted.

In this connection I wish to speak of carp, some of which grow to the size of fair specimens of sturgeon. I was one time criticised for stating that these carp destroy other and more valuable species, but to-day there comes the complaint that young fry are being devoured by carp. As this fish has proved itself less desirable than was expected, it would be an excellent idea to allow it to be taken in all ages and sizes, or else these ravages will materially injure the business of the hatcheries.

A comparatively new business is progressing finely in the northwest in planting and preparing oyster beds and the better quality of lobster has also been transplanted. Puget Sound oyster canneries have only been in full operation for three years, and in that time they have increased in value one hundred and fifty per cent. Here again the danger threatens that injuries every other part of the fishing business. It is, as soon as the product shows phenomenal success other companies rush in to claim a share, and thousands upon thousands of really almost unsaleable stock will be spoiled in the pursuit of the more desirable kind. Let the fisheries get a good start, then allow just a reasonable amount to be taken at once; in time, the supply will increase to meet the greater demand, and the northwestern oyster fisheries may be looked upon to make up in a measure the great falling off of the Atlantic product.

It was this falling off that led Seth Green to open his eyes to a stern necessity for replenishment, when, in 1864, he began experimenting in artificial propagation of food fish. The good that his work has done now extends from one state to another all over the breadth of our land. The fish commission has become an institution of the Government, and to it the Pacific as well as the Atlantic fishermen and dealers look for supplies of some of the most valuable denizens of river and ocean. Through the efforts of the commission salmon has been restored to the east and shad made known to the great west. From this we must be assured that their every effort should be appreciated and their millions of fishes protected from extermination. To do this plans must be legislated to prevent the vast numbers of the products of the waters to be met with yearly increasing arrangements for their destruction. Because an immense haul is expected, greater facilities are greedily and hurriedly completed, as if it were not wiser to permit this year's fish to insure as great results for next year.

But a short time ago we heard of the "sock-eye" salmon, next we hear of the millions that are taken and the great wealth that is being expended upon new fisheries for their capture. Oysters are becoming abundant, therefore, on rush the speculations regarding them, the calculations of their value this year by their lesser value last, until in very little time there will be more deserted canneries, more buildings to fall to decay, more men disappointed in employment, more speculators mourning over financial loss.

Another trouble appears at this present crisis, as the Atlantic fishermen have decided to join with those of the Pacific in cod, halibut and other fishing. The war is truly blameable to an extent for this, but, indeed, the Atlantic fisheries have been in a doubtful condition longer than the war can have been threatened, taking even the first grumble ten years ago. Unquestionably, the United States Fish Commission will find ample work on either side of the Union to provide a large enough supply for the dual demand. This cannot be done by propagation only, but by a judicious economy in the fishing permits granted to companies, or even individuals, as some are quite equal to carrying on a large independent business. Therefore, the commission should first extend the jurisdiction so as to embrace all the fisheries, even the sponge fisheries of Florida. But as I am particularly limited to the Pacific coast, I should say that no fishery should be entirely independent of the commission's careful supervision, even where the myriads of fish seem to promise inexhaustible supplies. It should guard all from depletion, and by so doing the profit will continue at a consistent ratio over decades, or we may say, centuries of prolific business, instead of being rushed through at lightning speed, with but a few individuals or corporations gathering the enormous profits, leaving so little that even the natives of the most distant points will suffer, if not perish, for want of their annual complement of nature's provisions for their maintenance.

A grand movement in the proper direction has begun in the establishment of schools for the study of the habits and culture of fish. In the pursuit of this subject, for instance, I find that the Fraser River salmon has a supply of oil in its composition which aids in the preservation of the flesh, and it suggests to my mind the utility of compressing the oil from the heads and tails, the discarded parts from the canneries, and using that oil for the preserving of these salmon and others of different kinds that require the addition of oil.

I would second the idea, also, of inventing some plan for using up the skins, heads, tails and other refuse, not only of sturgeon but of all fishes at the canneries. The prevention of the enormous quantities of offal being left to render the atmosphere pestilential would be no less desirable than that so much objectionable matter should not be returned to the sea in decomposing streams when rain fell in copious showers, thus providing literal poison for the living fish. And this kind of protection is extremely desirable, for even in the waters of Alaska fishes have been found with diseases or with parasitic enemies that cause sloughing. At first this latter trouble would seem like a sort of cankerous malady, but it is known that fish never renew their scales, nor do those that have no scales renew their skin to its normal condition after having been injured. If then, the parasite that renders one fish unsightly is freed from that fish and cast among others it is natural to suppose that the objectionable creatures will multiply upon the other fish with which they come in contact.

With limitations in the catches, even to the establishment of off seasons when necessary, I would earnestly suggest that the refuse matter from every cannery or drying and salting station should be turned into oil, glue, or possibly, dry compost. And if none of these commodities can be obtained from it, then let the useless offal be burned, either chemically or with fire. I should think that there could be cheap furnaces made of rocks and stones, and the fires once started could be kept up by the judicious distribution of the refuse. Would it not pay to consume or otherwise decompose the matter that will assuredly injure the very young and delicate food fishes, the flavor of which is their chief attraction to the consumers?

That California has its profitable fisheries, that Mexico has opened the Pacific coast of Lower California to the world of fishermen, that Alaska and British Columbia teem with millions of salmon and other fish does not say that there need be no more thought of economy or protection. A glance will show that both are now more absolutely requisite than ever, for the tide of the Atlantic will turn to the west in colonies of disappointed, heart-sick men who know nothing but how to take and cure the food productions of the sea. They will flock toward the fishing grounds as do the gold seekers to the new Eldorado. It will not do to wait until their migration happens. It would be ungenerous to let them go and then supply laws of which they know nothing. Instead, let the commission carefully prepare schedules of the regulations that they know to be required for the protection of the fishes, and through that for the longevity of the fisheries, and follow this by presenting them to the proper authorities for inspection, consideration and legislation. Follow the matter so that it must be put through quickly. Include every kind of fishery in this—that is, the oyster and sponge and pearl, as well as well-known fish from whale, seal and walrus, down to the tiny, delicious smelt. If this is done now while these fisheries are in comparative infancy, there will be no danger of extermination, no cry from men who have lost their legitimate business through ignorance or carelessness.

There is, and will be, increased demand for canned fish, as they are now included among the stores for army and navy, but there is great fear of over-production, particularly if the war is soon ended. Then it becomes again necessary to warn, not only against over-supply, but also against using any but the best manner of preserving fish, so that no one can be injured when the goods are cheapened and sold to the people.

As food, fresh fish well preserved and carefully canned, is desirable both for health and variety of menu. But diseased, decomposed or chemically tainted fish is not only an abomination but an active poison.

When preparing the new fishing laws, this phase of protection should be most elaborately introduced, for the selfish reason that people will not buy any goods of the kind if the reputed harm they do is accepted as fact, as well as for the humanitarian reason that it is unjust to permit inferior commodities to get in the market.

When all things have been done to prevent over-supply, over-fishing even in teeming streams, and improper preserving—when the rivers are protected from poisonous matter, and all the parts of the production are utilized, then may the commission promise, through these protective laws, and increasing numbers of artificially hatched fish, to make the fisheries of the Pacific States and Alaska as nearly inexhaustible as it is possible for such to become.

I know that there has been squabbling and dissatisfaction between Washington and Oregon, between Alaska and British Columbia, and this proves that both States and countries must conjoin, nationally and internationally to protect their fish, and then to amicably share their profits in the animals which make both States and nations equal as they pursue the beautiful tenor of their lives among the intersecting waters that make all States and countries their own.

Mr. Whitaker: The next paper is one prepared by Hon. John W. Titcomb, commissioner of fisheries and game of Vermont:

DESISABILITY OF STATE ORGANIZATION FOR THE PROMOTION OF FISH CULTURE AND FOR THE PROCUREMENT OF STATE LEGISLATION FOR THE PROPAGATION AND PROTECTION OF FOOD AND GAME FISHES.

The objects of the American Fisheries Society obviously cover the title of this paper to the extent that it might be more plain to the members if it read: Desirability of State Organizations for Promoting the Objects of the American Fisheries Society.

Nature liberally provided the waters of the world with food for man and has been lavish in allowances for waste both from natural and artificial causes and the improvidence of man. With the progress of civilization, the increase of population and the change in natural conditions caused thereby with the consequent increased demand for fish food, the lavishness of nature is set at naught. It will be conceded that the fish in the waters are intended for the use of man. Their protection then is simply a safeguard to prevent the supply from being exhausted and to make the production, whether artificial or natural, as useful to man as possible.

It will be conceded by all members of this society that the artificial propagation of fishes has passed beyond the experimental stages and that it is political economy for States to engage in fish culture. It will also be conceded that nearly all fish must be protected at certain seasons if they are expected to reproduce their kind and nature is to assist in the work of the hatcheries. How many of our State legislatures are convinced as to the desirability of propagating and protecting fish to the extent that wise laws prevail which are not subject to radical changes or repeal at each recurring legislative session? Nearly, if not all, the States have some kind of protective laws, some wisely drafted and more that have no reason for existence. Protective laws, so-called, often defeat the very object for which they are enactd. It is a common custom for legislators who want more liberal laws, which, for example, provide for the use of nets in waters where nets should be excluded, to draft a bill reading somewhat as follows: An act for the protection of fish in Lake .... and then follows a bill providing for the extermination of fish in said lake.

In listening to many valuable papers read during the National Fisheries Congress at Tampa last January, of interest to both sportsmen and commercial fishermen, I was impressed by the fact that almost every paper, scientific or otherwise, alluded to the question of legislation and the condition of public sentiment. If the paper did not allude to legislation, the discussion which followed its reading would do so. Examine the laws of any State and many will be found which are practically void. I do not refer to fish laws in particular, although this class of legislation will be found in the above category quite as frequently as any other. Two reasons will be found for the lack of observance of void legislation. First, the laws may not be wise ones and have no good reason for existing. Second, public sentiment is opposed to the laws either because they are unwise or because the people are ignorant of the real reasons for their enactment. This public sentiment may or may not extend throughout the State and it may be limited to one town or one county in the State. If public sentiment throughout the State is opposed to the observance of a law, its enforcement is practically void. If one townor county is opposed to the law, it is for purely local selfish and short-sighted motives, but it tends to make the law ineffective if its enforcement is left to local officers. It frequently occurs that the small section of a State in which the law is unpopular can send a strong enough representation to the leislature to obtain its repeal against the best interests of the State at large. All such work injures or weakens the efficiency and popularity of protective laws in general. The average legislator becomes disgusted with the frequent introduction of bills for the propagation and protection of fish and pays little attention to them unless such bills are called to his attention as directly affecting the interests of his constituents. He often goes to the capital with certain objects in view and interests himself in executing those objects by the passage of certain bills regardless of other interests. I do not intimate that he is dishonest, but his energy is exerted in the interests of his own constituents. He has not time to investigate proposed legislation on the fisheries, for instance.

If then, the legislature does not believe in the propagation and protection of fish, an organized effort must be made to educate legislators as to the value of such work. The political economy of such legislation must be demonstrated and an appeal made to their pockets. This work should begin by educating the entire people of the State. The education of the people and the shaping of good legislation go hand in hand. The representative of a community is usually chosen because he has been successful in the management of private interests. If he sees that his constituents are interested in certain legislation, he will interest himself sufficiently to act intelligently upon it. I have attempted to show the necessity of organization to promote the objects of this society. I will now describe an organization which has been doing successful work for nearly eight years. It has been said that fish and game protective societies seldom live more than two or three years. Such is too often true, but if they are managed upon a strictly business basis, their period of usefulness will continue as long as the objects and aims need fostering.

At the risk of appearing egotistical because I was one of its promoters, I will describe the Vermont Fish and Game League, how it was organized and what it has accomplished. While its work is confined to a State with commercial interests of comparatively small importance, the same kind of an organization can be effected suited to the needs in other States. Some States already have similar organizations.

Methods of Organization: The first steps taken were as follows: A circular letter was sent to every postmaster in the State asking him to name all the citizens in his town who would be interested in a State organization for the protection of fish and game. A reply card was inserted. An alphabetical index of all names received in reply to this circular was booked and a second circular was sent to all whose names were thus booked, inviting them to pledge themselves to join a proposed league with the above named objects, to agree to pay a certain fee (in this case $5) when one hundred names had thus been pledged and with the understanding that no articles of incorporation would be procured or organization effected until the one hundred names were pledged. The same circular requested each recipient to send in names of eligible members. Frequently the same names were sent in by several sportsmen in one community, showing the desirability of keeping an alphabetical index of all eligibles to avoid repetition in sending out circulars and to have as complete a record of eligibles throughout the State as possible. In response to the second circular, 111 names were pledged and articles of incorporation immediately procured and organization effected. A meeting of charter members was called, a constitution and by-laws (previously prepared) was adopted and officers elected. Of the 111 charter members, all but one redeemed his pledge by paying into the treasury $5. From the date of organization in 1890 to the present time, the membership has constantly increased, until the present membership is 563. After the first year, the membership fee was reduced from $5 to $3 and the annual dues from $3 to $2. Town and county protective associations were admitted as branch clubs and permitted to send one delegate as a voter in all business meetings. Regular meetings are held annually and special meetings from once to twice per year. At the annual meeting a dinner is given after the business is transacted, followed by post-prandial exercises. The past three years a so-called mid-summer meeting has been held on an island in Lake Champlain. At these meetings many notable men are gathered. On the occasion of the last meeting President McKinley was present as a guest. Politics are not allowed to enter into the work of the league or to be discussed in the meetings nor enter into the post-prandial exercises.

The subjects in which the league are interested are kept constantly before the people by means of cloth posters giving a synopsis of the laws, pamphlets containing the chapter of game laws in full, by frequent circular letters to the members scattered throughout the State and by the voluntary aid of all the newspapers published in the State.

The people must know the reasons for the fish and game laws and that they are not designed for the especial benefit of the fishermen, but for all the people. There should be no protective law—no close season on fish and game without a good reason for it. When the people are convinced that as a matter of political economy fish and game must be protected, they should understand that the laws are framed with especial reference to the habits of each species thus protected. Take, by way of illustration, the statutory limit on fish which can be legally caught—the six-inch law on trout, for example. All the people should know that trout will not reproduce in our streams until they have arrived at an age when they will have attained a growth of six inches or more. They would then understand that if allowed to be caught before they are six inches long, reproduction ceases and with the excessive fishing now prevalent, all trout will be killed before arriving at the age of reproduction and total extermination follows. Artificial propagation and stocking cannot replenish the waste. The same rule applies to the statutory limit on salmon, lobsters, etc. The statutory limit for each species to be legally caught should be one which will permit natural reproduction at least once before capture or there is little argument for the law.

When the league was organized eight years ago, public sentiment was at a low ebb so far as fish and game interests were concerned. With its inception, an appropriation for a State hatchery was secured and liberal appropriations for its maintenance and extension have followed. Through the interest awakened by the league, a national hatchery was located in Vermont. The game laws, which were in a wretched condition, were codified and revised by a committee from members of the league, presented to the legislature in the form of a bill which at the same time repealed all existing legislation of the same nature and became a law almost without a dissenting vote. Our legislators are beginning to consider it a matter of political economy that these interests should be fostered and the league loses no opportunity to present to the public and to the skeptic the arguments which will appeal to their pockets.

I would not have you think that our laws are perfect or that what has been accomplished was attained without hard work on the part of the administrative force of the league. We have asked of our legislature what we thought we could obtain. As public sentiment increases, more desirable legislation will be asked for.

The poacher, like the poor, is always with us. He is only kept in check by rigid enforcement of the law whenever opportunity offers. When necessary, we do not hesitate to send to the city for a good detective and pay the costs out of the league treasury. In Vermont the league is the strong right arm of the Fish and Game Commission.

If any one is lead by the arguments in this paper to organize a similar society, let him consider well two important features. The work connected with its promotion and future success is tremendous. No salaried officers exist, although in a State of such important fishery interests as, for example, Florida or Louisiana, there should be enough of a support to pay the salary of a stenographer.

Work of this nature once successfully undertaken by one or two actively interested persons cannot be dropped by them after the organization has been put into working condition. One man does the most of the work. He should be familiar with the fisheries of his State and not be prejudiced in favor of either sportsmen or commercial fishermen.

We believe in the social side of the organization as contributing largely to its success, but our membership is too scattered to meet socially more than twice a year.

Mr. Peabody: Mr. Titcomb is perfectly saturated with his subject and is the best posted man on that subject in the country.

The Chair: What is the next paper?

Secretary Whitaker: The next paper is one prepared by Dr. Henry B. Ward, which will now be read:

AQUACULTURAL EXPERIMENT STATIONS AND THEIR WORK.

The United States is justly famed among the nations of the world for the rapid advance it has made in methods of agriculture. Primarily this is, of course, due to the sagacity of the people and to their adaptibility in taking hold of new ideas and applying them to the given conditions in any locality. But a most powerful factor in aiding and directing this development has been unquestionably our admirable series of agricultural experiment stations. In every State and territory in the Union at least one such establishment, founded by State liberality and fostered by generous grants from the general government, is working uninterruptedly at the problem of agriculture in that region. In these stations the subject of agriculture has received, for many years, the closest attention of scientific workers. Not only the character of the different products, their food value for different uses and in connection with the raising of different kinds of stock, but also the preparation and enrichment of the soil, the development of the seed, the growth of the plant, the dangers that threaten it, the diseases that attack it, its protection and improvement, are all subjects of continued investigation.

Contrast with this, if you please, the conditions which exist in fish culture: "Despite the painstaking investigations of a few scientific workers and the encouragement of some official boards with limited means, aquaculture has been almost as much neglected as agriculture has been advanced. The incentive given by the work of Hoy, Milner and Forbes on the Great Lakes a quarter of a century ago has not been followed up; chance has been relied upon to control the conditions in these vast inland seas, and the fundamental features of the problem are as little understood to-day as when there was no drain on the life in these waters. No farmer is so ignorant as to suppose he could scatter the seeds of a grain whose development was entirely unknown over the land of which he was equally ignorant, and leaving the land could hope on his return in the fall to reap a bountiful harvest. And yet this is just what has been looked for in the case of the whitefish." This aspect of the question was very sharply put by Prof. Jacob Reighard in a paper read before the International Fisheries Congress in 1893: "If we inquire into the facts concerning the sufficiency of the present methods of artificial propagation," he says, "we find that so far as the whitefish is concerned, there is no question as to the success of the earlier stages of the process. Several hundred million ova are taken annually and placed in the hatcheries and of these usually from 80 to 90 per cent. are hatched and placed in the waters of the Great Lakes—165,000,000 in Lake Erie alone in 1888.

"This is very nearly all that we know about these young whitefish. About their food habits we know only that in captivity they eat certain species of crustacea. Whether in their natural habitat they eat other animals in addition to these crustacea or in preference to them, we do not know. It is uncertain at what age they begin to feed or how much they require. We do not know their natural enemies. We do not know whether they thrive best in running water or in standing water, in shallow water or in deep water, whether at the surface or near the bottom. What changes of food habits or of habitat the fish undergo as they grow older is still deeper mystery.

"Our problem is to place young whitefish in the Great Lakes under such conditions that as large a number as possible of them shall grow into adult fish. It is clear that of one of the elements in this problem namely, the whitefish, we know but little.

"What then do we know of the other elements of the problem, the Great Lakes themselves? Individual naturalists have, from time to time, made efforts to study one or another of the groups of animals living in the lakes. These efforts have been circumscribed by the facilities at hand by the time that could be devoted to the subject, by the small area examined, or by the small number of animals taken into account. * * * We are thus in the position of bringing together under unknown conditions, two things, both unknown in character; and we expect as a result to get a third thing, marketable whitefish. Should we not pursue our object more intelligently by first determining the characteristics of the materials with which we have to work?"

What Prof. Reighard has said of the whitefish may be said of other species with equal truth. Clearly present methods have reached their limit and the subject must be attacked from a different standpoint. Aquaculture must be given the same sort of treatment that agriculture already receives at the hands of the thousand trained investigators in experiment stations that are located in every State in the Union. It must be studied from the same scientific standpoint; its problems analyzed, its course marked out definitely. As I have said elsewhere in discussing one side of the problem: "Fish culture will never attain its proper results until it receives, by the liberality of the State and nation, the same favors that have been extended to agriculture, the use of permanent and well equipped experimental stations where trained workers shall devote their time and energy to the solution of its problems. The Great Lakes furnish a cheap and valuable food supply to one-third of our entire population; this food supply is rapidly becoming depleted. How long must such important interests wait their just recognition and adequate protection? And if properly developed, who can limit the possibilities of these inland seas in supplying the nation with food? The urgent need of the present is not a mere biological observatory, however valuable such a permanent foundation may be, but a well equipped and well directed experiment station to attack the peculiar problems of fish culture in the Great Lakes.

The idea is by no means entirely novel and much work has been done preliminary to the foundation of such a station. The classic researches of Forbes on fish foods, of Birge on the crustacea of the plankton and of many other individual observers, have opened questions of extreme scientific and economic importance. Some years ago the Michigan Fish Commission, under the able leadership of the Secretary of this society, carried on through several successive summers biological investigations first on the inland lakes of Michigan and later on Lake St. Clair and Lake Michigan. For the past three years Illinois has maintained on the Illinois River a biological laboratory where, under the guidance of Prof. Forbes, the problems of a river system have been undergoing careful investigation. The United States Fish Commission has had for years an important investigating station at Woods Hole, but is work has been largely confined to the summer months. Numerous other less extensive enterprises might be mentioned, but these will suffice to show that the time is ripe for such an undertaking of a more formal and extensive character.

If the establishment of an aquacultural experiment station is advocated one may well inquire as to the most favorable location and as to the work it may be expected to perform. And at the start it may be noted that a single station is but the beginning, for just as agricultural experiment stations are found in every State, so aquacultural stations should be distributed so as to afford opportunities for the investigation of all conditions for the development of life in ocean, lake and stream. For the pioneer enterprise one may justly say that a lake presents the most favorable location. It is, as Forbes has said, a world within itself, a unit of environment and has thus evident advantages over the ocean or stream as a starting point for study. In the Great Lakes I believe we possess such favorable units for investigation, while at the same time the economic questions associated with the depletion of the whitefish are of pressing importance. Almost any location which might be chosen on one of the lakes would also afford within easy reach smaller inland lakes for such comparisons as should prove advisable.

Both the general government and the individual States have already in existence more or less extensive plants connected with the various hatching stations, and these might well be made use of in establishing aquacultural stations with evident saving in equipment and working force, since the expensive pumping apparatus, for instance, would serve with little or no modification for both purposes. The intimate association of the scientific experimentation and the hatching might be expected to redound to the advantage of both. It is also evident that such an aquacultural station would be fitly combined with such a large aquarium as has been advocated in Detroit for some years.

Following along the line of successful work in agriculture, such a station should possess a working force composed of men trained for scientific research and, associated with them, assistants having thorough personal acquaintance with the problems of practical fish culture. The work to be done must be attacked in a thoroughly scientific fashion; no superficial study will really succeed in throwing light upon the problems that are presented. To this end the foundations must be laid broad enough to insure the permanent value of the work. And equally with thoroughness continuity is essential; experiments and observations must extend throughout the year and even through a series of years. Herein lies a real danger of the plan, for ultimate success demands that the work proceed independent of results, while impatience for some return is a most characteristic feature of American life.

If the work of an agricultural experiment station is great, equally so is that of an aquacultural. The latter deals with all conditions of existence which present themselves in the water. It seeks to ascertain of what the food of each fish consists, in what amounts it comes and where that food is found, how the amount may be increased and even how it may be improved by the introduction of new elements imported, it may be, from distant parts of the world. Experimentally it would strive to determine to what extent an increase in the number of the fish was both possible and profitable and how this increase could best be attained. Furthermore, in the light of food supply, the investigator would institute comparisons as to the best kinds of fish to raise under given circumstances, and, not content with this, would endeavor, experimentally, to produce new races of fish and to domesticate suitable forms. It is not necessary to carry this analysis further and I only need to call attention in passing to the patent fact that other living forms than fish are of considerable economic importance on the continent and might well be here. The introduction and improvement of such forms would clearly be one function of such aquacultural stations.

The problems outlined are indeed vast, and yet we may be confident that their solution lies easily within the power of the human intellect, for they are all paralleled in the history of the agricultural development of the race; and man, relying upon his success in the past, may go forward with supreme confidence to the attainment of their solution in this new field.

Mr. Clark: I don't wish to take up the time with any argument, but Prof. Ward's paper is right in the line of what I had been advocating for ten years on the subject of the work of the scientists in this direction on the Great Lakes; that it should be continued from month to month during the year. I have argued that the summer campaign of these men has never developed or brought out what practical fish culturists want to know in regard to the habits of the fish in the great lakes. I think that the scientists are taking a step in the right direction. The scientists and the fish culturists and everybody should keep together.

Prof. Birge: I think the paper puts the rule for the conditions of success, extremely well. I don't believe in a summer campaign. With all due respect to the college professors, I don't think they can do that work permanently. I think the work must ultimately be conducted by men who make it their life work, just exactly as with the agricultural experiment stations. We find in Wisconsin that the men who work in the stations do very little teaching. They hold the rank of professor, but they are expected to do little or no teaching. It is found that a man cannot give his time to the problem of agricultural conditions and at the same time do a large amount of teaching. If the man is going to reach real success in handling these practical problems, he must set up with them day and night, week after week and year after year. What ought to be done is for the United States Fish Commission to establish at least one such station and maintain it, as Prof. Ward says, without any expectation of immediate results of a practical kind, and put men in there to study the problems and find out how they can be established. Such a station would utilize the work of the college professor in the summer, and it would be made available; at the same time the work should be carried on by the regular employes of such station. I don't think that anybody can doubt that such a station must be established. When you try to throw even the small amount of work that we have done on a few, you will find at once the dense ignorance you have, you will find nobody knows anything about it; there are a lot of disconnected observations and knowledge that you can pick up, but when you try to get things together in some shape, nobody knows anything about it and nobody will know anything about it until an enormous amount of work has been done on a great number of different classes of subjects and the whole thing has been brought together by a continuance of the work extending over a good many years and when you once get that you can get practical results; such work as Forbes is at in Illinois is exactly what ought to be done. He is spending about $5,000 a year on the investigation of a single river practically; if he is able to continue that for a long enough time he will get some idea of the condition of fish life in the rivers.

Mr. Whitaker: There is one thing I want to say in connection with this matter. Something like six years ago the importance of this work of scientific inquiry into subjects relating to fish life and culture and the conditions that surround them and have bearing on fish life impressed its importance upon me. The matter was brought to the attention of our board, after a conversation with Prof. Reighard at Ann Arbor, and we determined to establish a field station. A certain amount of money was devoted to that work. The amount of money that was required was very insignificant compared with the value of the work done. It was thought best to make that work permanent, but the economy of the legislature finally compelled us to stop it after having prosecuted it for two or three seasons. I don't think there is any argument needed on the importance of the continuance of this work. It has always impressed itself as a necessity upon me. During his lifetime I interviewed Col. McDonald two or three times on this subject, urging him to take it up, telling him that we would be very glad to surrender the work to the United States Commission, and it was a work that ought to be kept up. At last it has come to the point where the work is liable to be put on a permanent basis. I believe it is going to result in much good to the cause of fish culture. What we want to know is something about the life habits of fish. It would be interesting to know whether there are given areas in the lakes that are stocked with the food of fish more plentifully than others, which would influence the decision as to the most likely places in which to plant fish. Of course, in connection with that there is this question as to the food of the fry. Can we determine anything about the conditions that are necessary to give the best results to be expected from planting? If we can do that we are acting intelligently as fish culturists. We should get at those things which are as important for the fish culturist to know as it is important for the farmer to know the constituents of his soil. It is a fact that this work has heretofore been done in a spasmodic sort of a way and it is a fact that we have been unable to establish anything like a permanent force to carry on the work the year round. It is a fact that the scientific gentlemen who have thus far been active in this work have donated their time and that their vacations have been given up to it, time they ought to have devoted to getting a little fresh air into their lungs. But we find that the scientist is a very peculiar animal, that he enjoys spending his vacation in labor that is congenial to him; he does not seek to resort to the green field nor care to throw himself under the spreading branches of the oak and read a dime novel. His idea of recreation appears to be to get out and prosecute some independent and original work, all of which is very gratifying, I have no doubt, but unless some good systematic plan of work is adopted and carried on regularly, such work will be of little practical benefit to fish culture. Of course there are many collateral inquiries necessary, but we first ought to follow out the life history of the fish. The establishment of a good station for scientific study on the Great Lakes would probably result in a summer school such as we now have at Woods Hole. I think it is a matter of congratulation that something is now promised on the lakes similar to that now done on the ocean. In good hands and with permanent workers, eventually this work will redound to the benefit of fish culture, and I will welcome it as sincerely as anyone can.

Mr. Peabody: There was some talk last year of a convention of representatives of the States on the Great Lakes, regarding the matter of protection to the fisheries. Has anything been done?

Mr. Whitaker: That matter was left in the hands of the President. That information would more properly come from him.

Mr. Peabody: I would like to ask if the membership of this society is confined to residents of the United States. Its name is the American Fisheries Society; is there anything that would prevent securing members from abroad or in Canada?

Mr. Whitaker: No, America embraces it all.

Mr. Peabody: I don't know but it would be well to offer a resolution that the governors of the States bordering on the lakes appoint delegates to meet with this society at our meeting at Niagara Falls, and have them listen to the discussion regarding the ideas of fish culturists. Some of the governors of the States on the Great Lakes know nothing of this society. Can we not arrange in some way to have them meet with us? I don't know what has been done, but cannot something be done by which we can have that matter come to a head next summer at Niagara Falls?

Mr. Whitaker: I took occasion to write to Prof. Prince, of the Canadian Fishery Department, asking him to participate personally in this meeting, or by a paper. I never even received an acknowledgment of the letter.

Mr. Dale: Let Mr. Peabody as President and Mr. Whitaker as Secretary, issue a circular letter to the gentlemen living in Canada who are interested in fish culture, inviting them to attend the meeting in Niagara Falls.

President May: Do you want the society to take action on it at this time?

Secretary Whitaker: I will send an announcement of this meeting to those gentlemen.

Mr. Peabody: Now regarding the States bordering on the lakes, why wouldn't it be a good plan for the Secretary to communicate with the governors of those States, arranging for representatives from the lake States to attend the meeting at Niagara Falls?

Mr. Whitaker: Why not make a motion that the Secretary be authorized to communicate with the governors of all the States a sufficient time prior to the next meeting, calling their attention to this Society, its aims and objects and the desirability of having them appoint delegates to attend the meeting?

Mr. Peabody: I have drawn up and offer a resolution that the governors of all the States appoint delegates to be in attendance at the next meeting.

The resolution was supported and unanimously carried.

Secretary Whitaker: In that connection I want to say one word; the work in the office of Secretary is considerable, heretofore I have done all of it myself, this coming year I shall employ such force as is necessary; I think it is due the Society that I should state this.

Mr. Peabody: I will call for a resolution, providing that the Secretary be allowed $100.00.

Mr. Whitaker: I don't think that should be done.

Mr. Clark: I think the Secretary should have full power to use his judgment in those matters.

Mr. Whitaker: I shall not employ assistance except when it is necessary. I shall not abuse the privilege. The amount paid out for running the office last year was about $50.00 to $55.00, and I did most of the work myself; this year I must have some assistance.

I wish to offer the following: This Society learns with pleasure that steps have been taken by the Commissioner of Fisheries of the United States to establish on the Great Lakes a permanent station for scientific inquiry. We recognize the importance and necessity of this work, and the practical bearing its investigations must have on many of the questions affecting fish culture and its success as an economic problem, therefore,

Resolved, That in the opinion of this Society the importance of this work is such, that we ask the Congress of the United States to grant the necessary funds to place this work upon a liberal and broad basis so that the work of the artificial propagation and distribution of the important food fishes of the lakes may be carried on with a thorough understanding and familiarity with the conditions surrounding the fisheries and their needs as will lead to the greatest success of that work.

Prof. Birge: I move the adoption of that resolution.

The resolution was unanimously carried.

Mr. Whitaker: I wish to say that I communicated to Mr. Fred. Mather the fact that at our last meeting he had been elected an honorary member of the Society and received a letter from him in reply in which he desired me to extend his thanks for the courtesy shown him and to express a due sense of his appreciation for the honor.

Mr. Clark: As there was a great deal of talk at the time we reduced the dues of getting a great many new members, which I have no doubt will be done, I would suggest that it might be a good idea for every one to get as many new members as they can and send their names to the Secretary between now and the time our report is ready to be sent out so that these new applicants may receive the report. Would not that be a good idea? I know I could send in the names of four or five that would want the book.

Mr. Whitaker: The Secretary last year on his own responsibility inaugurated that system. I held this out as an inducement to new members, that they would get the benefit of two years' membership for one year's dues.

There is another thing I want to give notice of. I shall bring up at the next meeting an amendment to the constitution.

The constitution as it now stands allows the names of delinquent members to stand on the rolls for three years. I shall move to amend by cutting it down to two years.

Mr. Dale: Before we adjourn I think we had better adopt a resolution of thanks to the officers of the Trans-Mississippi Exposition and the Mayor of the City of Omaha, for the courtesies extended to this Society at this meeting.

On motion Mr. Dale and Prof. Birge were appointel to present a suitable resolution of thanks to the officials of the City of Omaha, the Press and the Exposition officials for courtesies extended the Society, and they reported as follows:

Resolved, That the hearty thanks of the American Fisheries Society be extended to the Mayor of Omaha for the cordial welcome given the Society, through his secretary, and for the keys of the city, opening the doors of its hospitality, rendering our stay here both pleasant and profitable.

The thanks of the Society are also extended to the public press of Omaha for the excellent reports and notices of our meetings.

We desire to thank the officials of the Trans-Mississippi Exposition for the privilege extended to the members in attendance upon this meeting, of free admission to the exposition at all times. We congratulate the management upon the happy culmination of its efforts to present to the people of this country an exhibition which is only second to the Columbian Exposition in the beauty of its buildings and grounds, and upon the creation of such a magnificent exposition of the material resources and wealth of the giant west. Here, grouped about the Grand Central Court of Honor are buildings of rare architectural beauty filled with exhibits of industrial skill, of mineral wealth, and with the agricultural products of a territory laid down upon the maps of a quarter of a century ago as embraced in the great American desert, evidencing in a marked degree the fertility of a soil which only needs the hand of the husbandman to furnish proof of its inexhaustible resources. To the management which has conceived and brought forth so grand an achievement we feel that the highest praise is due.

On motion, the Society then adjourned to meet at Niagara Falls, N. Y., June 28th and 29th, 1899.

LIST OF MEMBERS.

ACTIVE.

Adams, E. W., 114 Wall st., New York.
Alexander, L. D., 50 Broadway, New York.
Alexander, Geo. L., Grayling, Mich.
Amsden, F. J., Rochester, N. Y.
Anderson, J. F., 240 Eleventh st., Jersey City, N. J.
Annin, Jas., Jr., Caledonia, N. Y.
Atkins, Chas G., East Orland, Me.
Ayer, F. W., Bangor, Me.
Babbitt, A. C., Sault Ste. Marie, Mich.
Babcock, C. H., Rochester, N. Y.
Ball, E. M., Put-in-Bay, O.
Barrett, W. W., Church's Ferry, N. D.
Bartlett, Dr. S. P., Quincy, Ill.
Bell, Currie G., Bayfield, Wis.
Belmont, Hon. Perry, 19 Nassau st., New York.
Benkard, James, Union Club, New York.
Bickmore, Prof. A. S., Am. Museum Natural History, New York.
Birge, Prof. E. A., Madison, Wis.
Bissell, J. H., Detroit, Mich.
Blackford, E. G., Fulton Market, New York.
Booth, A., cor. Lake and State sts. ,Chicago, Ill.
Bottemanne, C. J., Bergen op Zoom, Holland.
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Bowman, W. H., Rochester, N. Y.
Bradley, Dr. E., 19 West 30th st., New York.
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Cheney, A. N., Glens Falls, N. Y.
Clark, Frank N., Northville, Mich.
Crook, Abel, 99 Nassau st., New York.
Crosby, H. F., P. O. Box No. 3714, New York.
Dale, J. A., York, Pa.
Davis, B. H., Palmyra, New York.
Davis, H. W., Grand Rapids, Mich.
Davis, Hon. G. B., Utica, Mich.
Demuth, H. C., 144 E. King st., Lancaster, Pa.
Dickerson, F. B., Detroit, Mich.

Dourcdoure, B. L., 103 Walnut st., Philadelphia, Pa.
Doyle, E. P., Port Richmond, N. Y.
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Ellis, J. F., U. S. Fish Commission, Washington, D. C.
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Fox, J. C., Put-in-Bay, O.
Friesmuth, E. H., Jr., 151 North 3rd st., Philadelphia, Pa.
Frothingham, H. P., Mt. Arlington, N. J.
Gavitt, W. S., Lyons, N. Y.
Griffith, S. L., Danby, Vt.
Gunckel, J. E., Toledo, O.
Hagert, Edwin, 32 North 6th st., Philadelphia, Pa.
Haley, Caleb, Fulton Market, New York.
Hamilton, Robert, Greenwich, N. Y.
Hansen, G., Osceola Mills, Wis.
Harris, J. N., Fulton Market, New York.
Hartley, R. M., 627 Walnut st., Philadelphia, Pa.
Henshall, Dr. J. A., Bozeman, Mont.
Hessell, Dr. Rudolph, 1209 H st., Washington, D. C.
Hill, J. L., 115 Broadway, New York.
Hinchman, C. C., Detroit, Mich.
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James, Dr. B. W., n. e. cor. 18th and Green sts., Philadelphia, Pa.
Jennings, G. E., Fishing Gazette, 203 Broadway, New York.
Johnson, S. M., Union Wharf, Boston, Mass.
Jones, Alexander, Wood's Hole, Mass.
Jones, Dr. O. L., 116 West 72d st., New York.
Kauffman, S. H., Evening Star, Washington, D. C.
Keene, J. H., Baltimore, Md.
Kelly, P., 346 6th ave., New York.
Kilburn, F. D., Banking Dept., Albany, N. Y.
Leach, G. C., 3915 Finney ave., St. Louis, Mo.
Lydell, Dwight, Mill Creek, Mich.
McGoun, Hon. H. P., 108 Fulton st., New York.
Mallory, Chas., Burling Slip, New York.
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Merrill, F. H. J., State Museum, Albany, N. Y.
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Nash, Dr. S. M., 23 West 33d st., New York.
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Preston, Dr. H. G., 98 Lafayette Square, Brooklyn, N. Y.
Preston, Hon. J. L., Port Huron, Mich.
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Rathbun, Richard, Smithsonian Institute, Washington, D. C.
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Russell, Henry, Detroit, Mich.
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Sherwin, H. A., 100 Canal st., Cleveland, O.
Spenceley, C., Mineral Point, Wis.
Steers, E. P., 2076 5th ave., New York.
Stelwagen, W., 525 Commerce st., Philadelphia, Pa.
Stone, Livingston, Cape Vincent, N. Y.
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Sweeney, Dr. R. O., Duluth, Minn.
Taylor, Alexander, 48 West 59th st., New York.

Thompson, Carl G., 504 Wabash ave., Marion, Ind.
Titcomb, J. W., St. Johnsbury, Vt.
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Walters, C. H., Cold Spring Harbor, Long Island.
Walton, C. W., 1713 Spring Garden st., Philadelphia, Pa.
Ward, Prof. H. B., Lincoln, Neb.
Webb, W. Seward, 44th st. and Vanderbilt ave., New York.
Weed, W. R., Potsdam, N. Y.
Whitaker, E. G., 141 Broadway, New York.
Whitaker, Herschel, Detroit, Mich.
White, R. Tyson, 320 Bridge st., Brooklyn, N. Y.
Wilbur, H. O., 235 3d st., Philadelphia, Pa.
Willetts, J. C., 49 Wall st., New York.
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